SCIENTIFIC AMERICAN

BUILDING RAILROADS UNDER THE STREETS OF NEW YORK.—[See page 46.]

Vol. CXIII. No. 2
July 10, 1915

Munn & Co., Inc., Publishers
New York, N. Y.

Price 10 Cents
$3.00 A Year

SCIENTIFIC AMERICAN

Founded 1845

NEW YORK, SATURDAY, JULY 10, 1915

Published by Munn & Co., Incorporated. Charles Allen Munn, President; Frederick Converse Beach, Secretary; Orson D. Munn, Treasurer; all at 233 Broadway, New York.

Entered at the Post Office of New York, N. Y., as Second Class Matter
Entered as Second Class Matter at the Post Office Department, Canada.
Trade Mark Registered in the United States Patent Office

Subscription Rates

Subscription one year..... $3.00
Postage prepaid in United States and possessions, Mexico, Cuba, and Panama.

Subscriptions for Foreign Countries, one year, postage prepaid, 4.50
Subscriptions for Canada, one year, postage prepaid..... 3.75

The Scientific American Publications

Scientific American (established 1845).....per year $3.00
Scientific American Supplement (established 1876)..... " " 5.00
American Homes and Gardens..... " " 3.00

The combined subscription rates and rates to foreign countries including Canada, will be furnished upon application.
Remit by postal or express money order, bank draft or check.

Munn & Co., Inc., 233 Broadway, New York

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp* the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.

The War Significance of Cotton

FOR warring nations, cotton is king. In the past cotton has been important in war merely as raw material for textile mills, the amount of it used to make smokeless powder having been very small compared with that needed for ordinary industrial use. Cotton is the principal ingredient by weight in all smokeless powders, which consist of nitro-cellulose of about 12½ per cent nitration. Strange as it may seem, more cotton is now being consumed in Germany for the manufacture of smokeless powder than for industrial use.

The greatest surprise of the war has been the vast expenditure of artillery ammunition. Not even the far-seeing German General Staff had contemplated such enormous expenditures, so enormous, in fact, that the entire ammunition supply of the United States Army would not last the German army two days. In their recent successful onslaught on the Tarnow-Gorlice front of the Russian army in Galicia the German artillery used, it has been stated by Lloyd-George, 200,000 rounds of ammunition from 3-inch to 12-inch in caliber in a single hour. So great is the defensive power of modern machine guns and rifles, that troops strongly intrenched can be driven out only by destroying the barbed-wire entanglements, leveling the parapets of the trenches to the ground and sending forward infantry before the enemy has recovered from the shock induced by a storm of explosive shell. Gen. Castelnau has said that shock must now be produced by an overpowering artillery fire instead of by attacks of infantry. Lloyd-George has recently stated that Germany is producing 250,000 rounds of field-gun ammunition a day.

While the majority of German guns are of about 3-inch caliber, she has immense numbers of heavy guns and howitzers ranging from 4-inch caliber to 12-inch, and she has been using large quantities of heavy-artillery ammunition. The amount of cotton used for every round fired will average well over four pounds. The expenditure of cotton in Germany is, therefore, about four times 250,000 pounds, or 1,000,000 pounds per day. That figure does not include the amount used for small-arms ammunition, that needed for the navy, or that used to make clothing for the army. One million pounds of cotton per day is 2,000 bales of 500 pounds each or 730,000 bales per annum, about one half the usual exportation of cotton to Germany. Germany's reserve supply of powder has undoubtedly been used up by this time and her future ability to wage war for a long period depends on a regular supply of cotton from the United States; for all other sources of supply are closed to her.

England is making the most strenuous efforts to prevent cotton from reaching Germany. She realizes full well that if she can stop these imports Germany will be beaten within a year. Cotton is different from copper, another essential, in that copper is indestructible and remains in some form or other in the country into which it is imported, while cotton disappears shortly after being manufactured. Moreover, copper cartridge cases may be remelted and used over and over again. In addition, Germany has considerable copper ore within her boundaries, and can eke out her copper supply by smelting ores which in time of peace could not be profitably used. She must import cotton, however, not only to clothe her population and armies, but to furnish her men with ammunition, without which their skill, courage and patriotism could not avail.

We have heard much talk lately about the "starvation of women and children" in Germany as the result of Great Britain's blockade. Senator Beveridge in his illuminating articles has exposed that fable.

It is a cotton starvation, not a food starvation, that Germany fears.

The Navy's Most Pressing Need

IF a layman were to ask any of the high ranking officers of our Navy what is absolutely the most pressing need of the United States Navy to-day, he would unhesitatingly reply "Our most urgent need is more officers and men, and particularly the former."

The highly technical character of the modern fighting ship, filled as it is with weapons of the nicest precision calling for most expert handling if they are to be at all effective, has raised the *personnel* to a point of importance as an element in the winning of battles which it never before held in all the history of naval warfare.

A modern battleship costing $15,000,000, and capable, if ably handled and fought, of putting an enemy out of action in a brief quarter of an hour, if it be undermanned and under-officered, or if its officers, fresh from the naval academy, are lacking in sea experience, may easily have its efficiency cut down seventy-five per cent.

One of the most able and enthusiastic of the officers of the Atlantic Fleet, speaking of the shortage of officers and of the fact that very young men from Annapolis, because of this shortage, are filling positions on the ships which should be filled by officers of higher rank and long experience, stated to the writer that, in this respect, the Atlantic Fleet at the present hour is fully 40 per cent below the standard of full efficiency.

"A rather strong statement," you say. Nevertheless, it is amply sustained by a comparison with conditions in other navies—in that of Germany, for instance, where we find that there is one officer to every nine enlisted men, whereas in our Navy there is only one officer to every seventeen men. Last year, moreover, with a total number of enlisted men of 61,000 Germany possessed 2,615 warrant officers, whereas our Navy, with about 52,000 men, had only some 700 warrant officers. The German navy, furthermore, had 40 flag officers last year, as against 18 in the United States Navy, and she had a total of 351 captains and commanders as against only 182 in the United States Navy.

For information as to the fatal shortage of men, amounting to some 18,000, we cannot do better than turn to the testimony of Admiral Badger, formerly Commander-in-Chief of the Atlantic Fleet, as given recently before the House Committee on Naval Affairs. In answering the question regarding the number of officers and men needed to fully man all the ships of the Navy for war with navy crews, the Admiral stated that there are required 64,000. Not all of these would be with the fighting fleet, however, for 6,849 would be required for the hospitals; prisoners' guards, traveling, etc.; the insular force; navy yards and shore stations; radio stations; recruiting stations; training stations; station ships and for manning navy yard tugs, etc. Adding these 6,849 to the 64,000 required for the ships of the Navy, gives a total of 70,849 men. At present there are on the roll 52,293 men, and the difference 18,556, represents the additional enlisted men required fully to man all ships with Navy crews.

On the subject of shortage of line officers Admiral Badger testifies that on January 1st, 1914, we had 1,783 line officers on the active list. He stated that to officer the fleet for war and provide for the necessary shore establishments, without any provision for casualties, 2,716 line officers are required. The difference, 933, represents the present shortage of line officers. The shortage of staff officers is in proportion.

And be it remembered in the presence of these figures that it takes ten years to make a naval officer of all-round efficiency.

So now, gentle reader, follow very closely what Admiral Badger has to say as to Administration policy: "The number of men needed for the Navy depends very largely upon the policy which the Administration may decide upon in administering the Navy—how many ships it is proposed to maintain in commission ready for war and how many ships are to be kept in material condition in reserve, ready to be used in case of emergency. If the policy of maintaining all the ships of the Navy available for war of the first and second line is adopted, then we are short of men in the Navy now. Those ships of fighting value held in reserve should, in my opinion, have nucleus crews of such size as not only to be able to keep the ships in good material condition, but also to permit of such organization and drill, including target practice with guns and torpedoes, as will keep them thoroughly trained for immediate service in war."

And yet it has recently been decided by the Administration, we understand, to reduce the strength of the Atlantic Fleet by 4 ships, or from 21 to 17 in the line.

The reduction will make for economy, and a showing in economy will be very popular—perhaps; but will it make for the efficiency of our first line of defense against a stroke which may fall upon us as a lightning bolt out of a summer's sky?

Atrocities in the Scholars' War

AMONG the atrocities charged to the German account during the present European war are the numerous executions of persons held as hostages for the good behavior of the communities from which these victims were taken, and, again, the wholesale killing of non-combatants in certain communities where sporadic "sniping" had occurred. Assuming that these cases of vicarious punishment have frequently happened, and assuming also that the general public views such measures with righteous indignation, we cannot help feeling that something of the same sort, with the *rôles* reversed, has occurred in the treatment of so-called "enemy" members by the various scientific and technical societies.

An editorial in a recent number of *The Engineer* admits that "it has always been one of the boasts of science that it did not recognize the boundaries created by geographers or politicians, and that even differences of race and language did not imply a divergence of interests when the claims of science were at issue"—which wholesome sentiment is followed by one of a different sort: "It is a thousand pities that this great tradition has been broken, but it can be honestly said that it is not the fault of Great Britain or her allies. The truth is that the way in which Germany has chosen to wage war, culminating in the wholesale murders which accompanied the sinking of the 'Lusitania,' has put her people outside the pale of civilization, and even sane-minded engineers and clear-thinking scientists have realized that it is no longer possible to allow the nationalities now at war with us to claim even the kinship implied by membership of the same technical society." The same editorial urges all British scientific and technical societies to expel their members who are citizens of hostile countries: as, indeed, many of these societies have already done.

Is this reasonable? It is altogether possible that the persons who could be justly held responsible for the present war might be counted on your fingers—perhaps the fingers of one hand. We are not prepared to name them, or to state their number more definitely, but certain it is that the average citizen of any one of the warring countries is, at this juncture, the victim of circumstances not of his making.

As to German scholars, we know that some of them have proclaimed intense partisan sentiments in regard to the struggle; but we feel sure there are many others who look upon it merely as an unspeakable nuisance, for which German politicians and militarists are at least as much to blame as anybody else. Surely in philosophical Germany there are still philosophers who look down from a serene height upon the squabbles of misguided humanity.

The great European war is, in fact, senseless and infamous. Would it not be becoming of the learned societies in the belligerent countries to show their detestation of it by ignoring its existence just as far as possible?

The wholesale expulsion of "enemy" members by the British societies is, we believe, not only unjust and puerile, but is also seriously inimical to the success of the task which will presently arise of renewing those co-operative relations among the various peoples of the earth upon which the progress of knowledge is so dependent.

We are glad to learn that a more temperate plan has been followed by the Astronomical Society of France, which, of its one hundred and fifty-seven "enemy" members, has definitely expelled only one, who was a signatory to the address "To the Civilized World." The rest have been suspended, pending action in each case, on its own merits, to be taken after the close of the war.

The German Scientific Station in Spitzbergen, which was founded in 1911 by Professor Hergesell, and has been constantly in operation, summer and winter, since that time, ceased its valuable activities at the outbreak of the European war. A party of scientific men which had sailed for Spitzbergen to relieve the staff was recalled, and the party at the station also succeeded in getting back to Germany safely with all their instruments and other equipment. This institution has carried on extensive investigations of the upper air with balloons, and was, in fact, founded primarily to study the conditions likely to be encountered by the expedition which Count Zeppelin proposed to take to the North Pole in an airship.

Notes on the War

Foodstuffs for Great Britain.—The Board of Trade returns go to prove that the dread of a shortage of foodstuffs in Great Britain in the event of a war of magnitude was unfounded. In fact the food imports for the month of April show big increases. Thus in April, 1914, in round figures, the food imports were valued at $308,000,000, whereas for the same month in 1915 they totaled $368,000,000, an increase of $60,000,000. Exports in the corresponding months sho wed a decrease of $38,000,000. For four months the imports showed an increase of $110,000,000 and the exports a decrease of $280,000,000. The increase in imports of grain and flour for April were about $20,000,000. Imports of meat, including animals for food, increased over $7,000,000; raw materials and articles unmanufactured increased about $30,000,000. Here we have another object lesson in the value of the command of the sea.

Italian Preparedness.—Probably none of the countries at war, not even Germany herself, entered the conflict with such a clearly-defined plan of campaign and so perfectly prepared with the means to carry it on as did Italy. The redemption of the lost territory has been the dream of Italian statesmen and soldiers for half a century—a fact which was perfectly well known to Austria, who had strengthened by every artificial means of a military character the naturally strong defenses afforded by her mountain-ribbed frontiers. The Italians were well aware that there was but one way to break through the fortified passes of the Alps and across the strongly defended river Isonzo, namely, by the battering power of heavy and well-served artillery. The steady progress of Italy in the extremely difficult task she has set herself would indicate that the stories we have heard of the excellence of the Itaiian artillery are well founded. Thus far, the campaign would seem to have been one of heavy howitzers in which the numbers of infantry engaged, relatively to the other theaters of war, have been small.

Essen vs. Skoda.—Apropos of our article last week on the Skoda big guns, we understand that the Austrians feel that much of the credit for the successful work of the Teutonic artillery in the war, which should have been given to Austria, has been credited to the German factories—such at least was the impression conveyed to us by a recent Austrian caller at this office. The following taken from *Navy and Army* (British) seems rather like an echo of the same sentiments. Says our contemporary: "One of the most remarkable features of the war has been the extraordinary success of the Austrian big gun. Essen has loomed so hugely in the limelight, and so much has been said about the wonders of Krupp's, as to obscure the significance of the Austrian artillery engineers. But Skoda has eclipsed Essen. The Germans had to wait until they could bring up the big Austrian mortars to pound Liège, Namur and Antwerp to pieces. To the man in the street Skoda is unknown, but it is an Austrian workshop of destruction as extensive and wonderful as that of Essen. To the Allies it is far more dangerous, as its big guns have never failed."

Peril at the Dardanelles.—The general public seems to have failed to grasp the tremendous significance of the appearance and successful work of submarines in the operations at the Dardanelles. On the Allied side the brilliant feat of a British submarine in penetrating to the Sea of Marmora has jeopardized the Turkish lines of communication by sea, several transports having been sunk already. If communications by land have been interrupted and rendered impossible at the neck of the Isthmus of Gallipoli by the flanking fire of Allied warships, the Turkish army is liable to be cut off from its base. On the side of the allied French and English troops the situation is even more dangerous; for the land forces on the western end of Gallipoli Peninsula must be dependent for ammunition and many other indispensable supplies upon free communication with the transports and supply ships. These forces also are dependent largely for their success upon the co-operation of heavy gunfire from the warships.

Trans-Atlantic Attack by Submarine.—Whether it be true or not that a German submarine navigated the distance from the North Sea round the coasts of Scotland and Ireland and through the Straits of Gibraltar to the Dardanelles or not, it is a fact that it would be perfectly possible for a flotilla of German submarines to negotiate the trans-Atlantic passage and maintain itself off our coast by means of secret bases in the West Indies, or even on the very coast of the United States itself. By filling its ballast tanks with oil in place of water, at the start of its voyage; by traveling at slow speed on the surface by night, and even by day when no vessels were in sight, it would be possible for one of the largest submarines to reach our coast with a reserve of oil fuel sufficient for several days cruising. A submarine base for replenishment of oil supplies would be a very small affair, and it could be snugly located on some unfrequented stretch of our coast, especially in the North; and the refilling of oil tanks could be done at night. It is as well to remember that a surprise submarine attack within our harbors and naval bases is to-day physically practicable.

Science

General Thomas H. Hubbard, well known as a Macænas of polar exploration, died in New York city May 19th. From 1908 until the time of his death he was president of the Peary Arctic Club. His name is permanently inscribed on the Arctic map at Cape Thomas Hubbard and the Hubbard Glacier.

The Permanent Wild Life Protection Fund, which Mr. W. T. Hornaday has been instrumental in collecting during the past two years, now amounts to more than $73,000. The income of this fund is to be used for conducting a nation-wide campaign during the next hundred years in behalf of wild life protection. Efforts will be made to stop the sale of wild game, promote laws to prevent unnaturalized aliens from owning or using rifles and shotguns, stop all spring and late winter shooting, stop all killing of insectivorous birds for food and of all birds for millinery purposes, increase the number of game preserves, etc. It is proposed to inaugurate next September a campaign in favor of creating game sanctuaries in the national forests on a very comprehensive scale.

The Tuberculous Tramp.—Under this designation Dr. A. J. Lanza describes in the *Public Health Reports* a class of persons who have proved a serious burden to the health authorities in the southwestern United States. They are usually young men who wander from one place to another, working when they are physically able and can get employment. In winter they seem to be most numerous in Arizona, while when the hot season comes on they depart by passing freight trains for Colorado or California. It is said that the extent of their wanderings is often remarkable, as well as the length of time they can keep going before they are finally disabled. "These tuberculous tramps," says Dr. Lanza, "are a pitiable and miserable class, always looking for some other place where they feel sure they will improve." Their wanderings, without benefiting themselves, spread tuberculous infection; and there seems at present to be no satisfactory way of dealing with the situation.

The Remains of an Extinct Ground-sloth, found in a cave in Patagonia and presented by the director of the La Plata Museum to Mr. Roosevelt, have been deposited by the latter in the American Museum of Natural History in New York. These remains possess extraordinary interest because the surroundings in which they were found seem to prove that the animal was living only a few centuries ago, and was not only contemporary with primitive man but was to some extent domesticated by him. Previously to this discovery it had been believed that all the great ground-sloths of South America, of which many fossil remains have been found, became extinct thousands of years ago. The remains recently found were in a dry cave, in company with tools or weapons of stone and bone, together with bundles of grass spread as though intended for fodder. There were other indications that the animals had been stabled or imprisoned in the cave and fed by their captors.

Radium Emanation in the Atmosphere.—One of the most elaborate investigations of the relation between the amount of radium emanation in the atmosphere and weather conditions is that recently carried out by Messrs. J. R. Wright and O. F. Smith at Manila, the observations extending over a period of about 13 months. The effect of weather conditions upon the rate at which radium emanation is exhaled from the ground and the relation of the rate of exhalation to the radioactivity of soil gas at different depths were also investigated. Rainfall and wind movement seem to be the principal meteorological controls, the amount of emanation in the air being greatest when these factors are at a minimum, and *vice versa*. A decided diurnal variation is found to exist, the emanation content being considerably greater by night than by day. The rate at which radium emanation is exhaled from the surface of the ground shows a decided decrease after periods of heavy rain.

The Volcanoes of the Lesser Antilles.—Dr. Edmund Otis Hovey of the American Museum of Natural History has recently returned to New York after completing the first expedition undertaken with the aid of the Heilprin Exploration Fund, established last year in memory of Angelo Heilprin. In view of the late Professor Heilprin's well-known work in connection with the eruption of Mt. Pelé, it was especially appropriate that the first work under the fund should have been an examination of the active volcanoes of the Lesser Antilles. Dr. Hovey visited Guadeloupe, Martinique, and St. Vincent. In the *American Museum Journal* he reports the present condition of the famous volcanoes in those islands. From the cone of Mt. Pelé considerable steam is still issuing, though much less in volume and lower in temperature than at the time of Dr. Hovey's last previous visit in 1908. The activity of the volcano has steadily diminished since the eruptions of 1902-03, and apparently there is no present danger of recrudescence. On the windward side of the volcano new vegetation has fully established itself, and even the forest is being renewed. The famous spine, or obelisk, which once rose more than 600 feet above the cone, disappeared nearly ten years ago. On the site of the ruined city of St. Pierre there are 30 new buildings and 200 people.

Inventions

An Unbreakable Watch Crystal.—Patent No. 1,133,780 to Bliss C. Ames of Waltham, Mass., describes a watch crystal of celluloid or other equivalent elastic transparent unbreakable material which in practice is sprung into an undercut groove or rabbet in the watch bezel, reducing the initial cost to the manufacturer and avoiding the cost of replacing broken glass crystals by the user.

Dyeing Device for Pile Fabrics.—J. A. Boyajean of New York city in patent No. 1,141,522 shows a liquid coloring implement which is specially designed for applying dyestuffs to pile fabrics and includes a pencil-like construction having a suitable supply connection with a source of dye supply and a tapered point which operates upon a valve to release the dyeing liquid.

An Easily Opened Envelope.—Few inventions have been more persistently re-invented than the provision near the end of an envelope of a series of perforations to facilitate the opening of the envelope by tearing off its end along the perforations. Raymond A. Merrill of New York city has in patent No. 1,142,349 modified this by providing an opening in the strip separated by the perforations and merging into them so it can be easily seen whether the contents of the envelope cross the tearing line or not.

Valuable Invention in Traversed Fields.—Many times important and valuable inventions are made in fields that seem to be well supplied. Take for instance so well known an object as the cartons in which many of the proprietary foods and other merchandise are marketed to-day. If one could devise a carton better structurally, more effectually sealed against moisture or other atmospheric conditions, of a distinctive shape, or as equally satisfactory in important respects and cheaper than the cartons now used, he would find a demand almost beyond imagination.

Testing at Bureau of Standards.—There has been a noteworthy activity in testing work at the Bureau of Standards recently, including hundreds of hydrometers, thermometers, and many tests of paper both for the Government and private parties, the samples of paper for private parties being more than ten per cent of the tests for the Government Printing Office and other Government offices. The Bureau is being utilized more and more by private companies seeking impartial, scientifically conducted tests of all kinds of materials and products.

Picture Hanger.—An all-metal extensible picture hanger is now in use which serves instead of the usual cord. To a ring which serves to suspend the hanger from an upper nail, are attached two decorative tubes of gilded copper containing telescoping rods at the lower ends. Such rods are curved into hooks at the bottom so as to be attached to eyelet screws in the back of the picture. This gives a good means of adjusting the height of the picture by the sliding of the rods in the tubes, and they are fastened by set screws. The present device gives a more decorative effect than the usual cords and unlike these it is not subject to deterioration.

Reducing the Visibility of a Uniform.—For the purpose of rendering a uniform, as the patentee describes it, "less easy visible," Albert S. Cox of Grantwood, New Jersey, has patented, No. 1,139,642, a military uniform or the like which has pronounced irregular alternating patches of contrasting light and dark colors with wavy outlines. Some of the darker patches are outlined in a still darker color, and smaller spots of contrasting color break up the color effect of some of the patches, so that the effect of uncertain light and shade is produced to cause the garment to mingle in a measure with the background.

The National Advisory Committee for Aeronautics.—President Wilson has approved the regulations formulated for the control of the advisory aeronautical committee, which include definite restrictions relative to invention. Pursuant to these the committee will not be able to encourage invention to the extent of supplying funds for the development, experimentally or otherwise, of inventions, although the committee will be able to carry on work along inventive lines for those who pay the actual expense incurred in so doing and this may prove beneficial to aeronautical inventors because of the advantage resulting from successful experiments under the direction of a committee national in character.

Actual Trademark Use Not Necessary to Injury.—In Electro Steel Company v. Lindenberg Steel Company, the Court of Appeals of the District of Columbia, in sustaining the cancelation of the trademark registration by the Commissioner of Patents, has held that while it is quite true to have a right to cancel or oppose the registration of a trademark is dependent upon a showing of interest, it is not essential in all cases, however, that there should have been a strictly trademark use of the words by complainant, since injury to its business might be otherwise shown. In this case the Lindenberg Steel Company used the word "Electro" as the name of the steel it was selling and also in its advertisements and letters. The proof shows that this company sells electric steel as electro steel and so represents it to purchasers through its selling agents, and buyers buy it as such.

At the Panama-California Exposition at San Diego

Beautiful Architectural Effects That Harmonize With Their Picturesque Settings

WHEN the Panama-California Exposition at San Diego, the first all-year exposition in history, was being planned, it was proposed to build it in the lower end of the 1,400-acre Balboa Park, almost in the center of the city of San Diego, because the site was easily accessible, the upper end of the park being cut by a deep canyon from which diverged other canyons, the slopes of which were too precipitous to allow an easy approach. When Frank P. Allen, Jr., who had been Director of Works at the Seattle Fair, came to San Diego, and was engaged as Director of Works for the Panama-California Exposition, after a survey of the park, the only large acreage available for exposition work, he urged that the plans be entirely abandoned and the city of Old Spain erected at the upper end.

"How about the canyon?" he was asked. "Bridge it," responded Allen. And so, against the advice of other engineers who said the cost would be far too great, Allen went ahead with his plans and threw across the Canyon Cabrillo the grand Puente Cabrillo, a great structure 1,010 feet long and 135 feet high at the deepest point.

There is an unpleasant recollection of the approach to various other expositions, chiefly over railroad tracks and through unsightly sections of the city. At San Diego the situation is different. The park is surrounded by the best section of the residential neighborhood, and the Puente Cabrillo itself is the most inspiring approach which ever lent dignity to any world's fair. The bridge itself is made up of seven cantilever units, and into its composition went something like 600 tons of steel and 10,000 barrels of cement. The arches are of the round Spanish type found in the cloisters and arcades of Spanish buildings and lend a suggestion of the harmony which prevails throughout the Spanish city which San Diego has built.

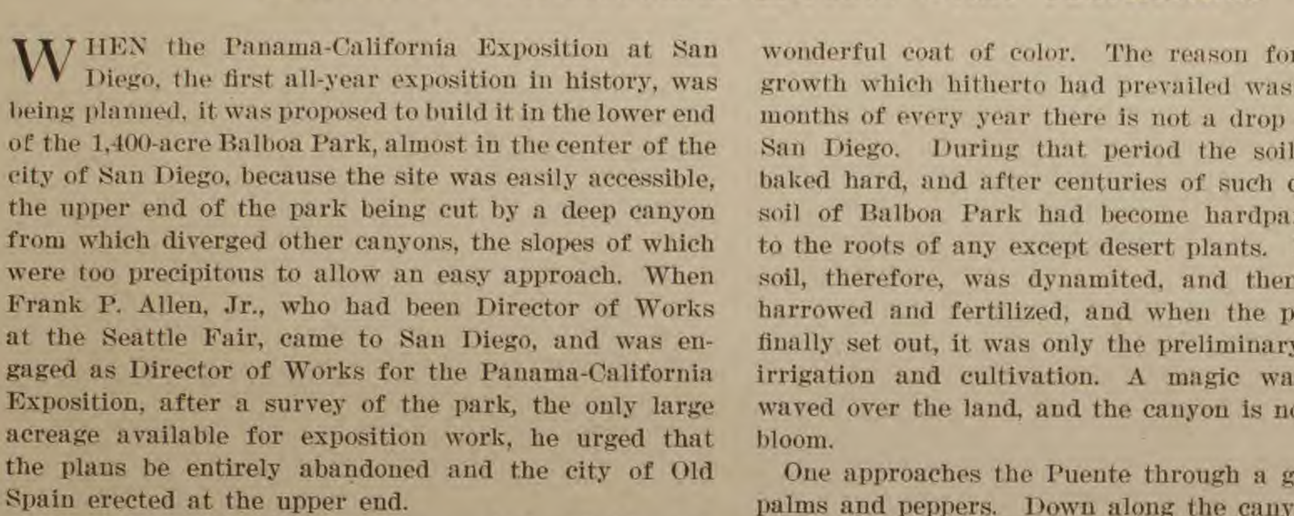
When the construction work was started the Canyon Cabrillo, like the other canyons, and like the mesa itself, was covered with a sparse growth of sage and chaparral and a little cacti, the whole foliage becoming a dreary brown during the dry season of each year. In three years the entire park was changed. Not only was the mesa covered with rarely beautiful buildings such as are found in the cities of Old or New Spain—the cathedral, the missions, the palaces and the country residences—but also the entire ground was given a wonderful coat of color. The reason for the scrubby growth which hitherto had prevailed was climate. For months of every year there is not a drop of rainfall in San Diego. During that period the soil naturally is baked hard, and after centuries of such conditions the soil of Balboa Park had become hardpan, impervious to the roots of any except desert plants. Every foot of soil, therefore, was dynamited, and then plowed and harrowed and fertilized, and when the plant life was finally set out, it was only the preliminary to incessant irrigation and cultivation. A magic wand has been waved over the land, and the canyon is now a burst of bloom.

One approaches the Puente through a great grove of palms and peppers. Down along the canyon slopes are groves of Italian and Monterey cypress, with patches of eucalyptus and acacia, the triumphant gold of the California poppy, and the great splashes of crimson, purple and white of other growths. In front of each building along the Prado stretches a double row of black acacia set in verdant lawns. Over the cool arcades which line El Prado is a thick growth of vine, sometimes the brick-red bongainvillea, sometimes the gorgeous purple, and sometimes rose or clematis or bignonia. In the gardens and patios are other floral wonders, something like 1,200 varieties in all, and millions of individual specimens. The effect of this floral cover is to create exactly the illusion for which the builders sought—the effect of a city which had been built for centuries, from the times of the padres or the still mistier days of the conquistadores whose first sight of the Pacific coast was the country which is now San Diego.

Not only do the buildings look as though they had stood for centuries, but also they look as though they were destined to stand for centuries more; and this is true of several of the buildings, for, like the Puente Cabrillo, the California building, the Fine Arts building, the great organ pavilion—the largest outdoor organ in the world—the Botanical building, and the quaint mission structure erected by the State of New Mexico, all are of steel and concrete. The others are of staff and plaster, but being placed on metal lath, in a country so blessed by climate in that it is practically free from frosts and gales, even those should last for twenty or thirty years.

In the same way many of the exhibits are of permanent nature, notably the enormously valuable scientific exhibit contributed by the United States National Museum and other scientific bodies, the result of several years of exploration in Central and South America conducted in behalf of the exposition, as well as decades of research in anthropology in other sections of the world.

The first all-year exposition in history is a triumph in many ways, not the least of which is its feat of going on a paying basis in the second month of operation. This is a record in world's fair history. It is, most of all, an architectural triumph.



In the grand Plaza de Panama.

The exquisite California Building.

Looking toward the sea from the Spanish balcony.

More Room for the Patent Office

THE architect has completed plans and bids were opened on June 13th, 1915, for the new Interior Department Building which is to be completed within eighteen months from the award of contract and is to be pushed to an early completion since the structure is to be of brick and will present no engineering difficulties.

The extensive improvements which are now being made and have been under way for the last two years in the Interior Department occupied by the Patent Office have cost over $100,000 and include new plumbing installation, new electric wiring directed particularly to better lighting and to fire safety, an automatic sprinkler system, new floors, and what is practically a new skylight.

In addition, an architect has been especially employed and is directing his attention to the betterment of the Patent Office and Old Land Office Building, occupying the square directly south of the Patent Office. When the new Interior Department Building is completed the entire Interior Department Building, now occupied in large part by the Patent Office, as well as a large portion of the Old Land Office Building, will be occupied by the Patent Office, thus greatly increasing its space.

In the carrying out of repairs in the present Interior Department Building the Patent Office has been particularly fortunate because Mr. E. J. Ayres, present Chief Clerk of the Interior Department, who has supervision of repair work, is a former *attaché* of the Patent Office and naturally retains a strong interest in Patent Office matters as well as an appreciation of its needs.

Graceful bridge across the Canyon Cabrillo.

Aerial Loops at Night

By J. Cecil Alter

THE accompanying photographs show the course of an illuminated night flight made at the Panama-Pacific International Exposition in a biplane by "Art" Smith, a 21-year-old aviator of Fort Wayne, Ind. During the first part of the ten-minute trip a red torch was aflame from each side of the lower plane, and the double lines of light show clearly in the larger photograph. Mr. Smith turned on the white light glare of firework pieces near the top of Fig. 1 and soon sped off the film to the right (east). Fig. 2 was exposed quickly and in a moment the biplane appeared, moving to the left (west) at the upper right-hand corner of the view finder. The splash lights or comet tails were in action, and the sputtering rays show on the path like hairs, flowing with the biplane.

Fig. 1.—Climbing in a broad spiral.

The first variation of the spiral climb was at an altitude of about 2,500 feet, where the dip was made; then came a "roll-over" to the aviator's right, then a drop, finishing in another roll-up, and a loop, with the lower planes toward the camera, thus showing both his white lights, plainly and unobstructed. Then followed another loop, which, in the camera map, looks like the lower part of the figure "5." Then follows a series of vertical and horizontal loops and dips. This same series of movements is shown in Fig. 3, photographed from another point of view. Just after the return toward the alighting place the aviator's lights went out. The landing was made in safety on La Marina, a narrow grass sward outlined for Mr. Smith by street lights.

Fig. 2.—Tracing the figure "5" in the sky.

Fig. 3.—Double lines of fire traced by two torches; the sputtering light produced by fireworks.

The Current Supplement

A SUGGESTIVE article in the current issue of the SCIENTIFIC AMERICAN SUPPLEMENT, No. 2062, for July 10th, 1915, is that which describes how effectively the Dominion of Canada is bringing her resources and attractions before the public by the beautiful and elaborate panoramic illusions at the Pan-Pacific Exposition. Besides being attractive and instructive to the public, it is an impressive example of the intense and effective publicity that has attracted so many settlers to the Canadian Northwest. This article is profusely illustrated. A valuable article on the Velocity of Hertzian Waves gives much interesting information on the methods used to determine the difference in longitude between Washington and Paris and the apparatus employed. The concluding article of the series describing the Manufacture of Shrapnel Shells tells how the big brass cartridge cases, such as are used for all kinds of field gun ammunition, are made. Where the Mathematician Could Aid the Astronomer is a plea for closer co-operation between different branches of science and discusses some astronomical problems. Problems of Geographic Influence considers the causes of differentiation of the white race. There is a concise description of the construction and use of the instruments for determining distances on battlefields, "range-finders," illustrated by excellent diagrams and sketches. Another timely article describes the instruments used on aeroplanes to assist in their navigation, such as air speed, level and revolution indicators, compasses and gages. The lectures on Photo-Electricity by Prof. Fleming are concluded; also the paper on the Manufacture of Condensed Milk. Another practical article in this issue is one on Modern Substitutes for Butter, which tells about the manufacture of oleomargarine and the preparation of other materials now widely used instead of butter. It throws a different light upon these substances from that in which they are generally viewed. Other valuable articles tell of the mobilization of raw war materials by Germany; how shrapnel bullets are made; fine measuring tools for machinists; how to mount small animals; an explanation of typhus fever, and other general information.

Philippine Asphalt

THE enormous deposit of asphalt of Leyte Province, in the Philippines, is now to be worked for the eastern market by a local company. This almost inexhaustible deposit lies so near the shore line at Tacloban that ships can anchor and take on cargoes of asphalt from lighters loaded at the mines with practically no overland transportation. There is a large and growing demand in the islands for paving asphalt and all the cities of the Far East are now in a position to offer a market.

The Strategic Moves of the War

By Our Military Expert—June 30th, 1915

FOR another week the Teuton hammer in the east has been delivering hard and well directed blows against the Russians, while the Teuton anvil in the west has been able to withstand the repeated onslaughts of the English and French. Lemberg, the capital of Galicia, is once more ruled by its own people, and the Russians have fallen back to the eastward for what will probably be their last determined stand on the Austrian side of their frontier. Two months ago the vast Russian army, that had marched triumphantly through Galicia, was in full possession of the passes through the Carpathian Mountains, and apparently ready to continue its victorious advance into the fertile plains of Hungary. The dual monarchy was downhearted and the extremely unfavorable situation which confronted the Teutons was made much more desperate by the entrance of Italy into the conflict against them. It was the most trying period of the war for the Austro-Germans.

Then came the Teuton drive from Cracow against the flank and rear of the Russian line in the Carpathians, a master strategic stroke, worthy of a great army and a great leader, which for nearly two months has steadily pushed the Russians back from one position to another until all Galicia, except a strip about fifty miles wide in the northeastern portion, has been recovered. The hopes of the Teutons have mounted high, and as they have risen great discouragement must have taken possession not only of the Russian army and people, but all the allied nations as well. The military prestige of the Germans has risen in the camps of foes as well as of friends, and the *morale* of the Allies has suffered in proportion. These are psychological factors in war that have a far-reaching and tremendous force. Their full value cannot be measured, but until the balance of prestige has been restored by a decisive victory by the Allies, the superior prestige of the Germans will be worth many battalions on every great battlefield. This is one of the great results the German has gained by his victorious eastern campaign.

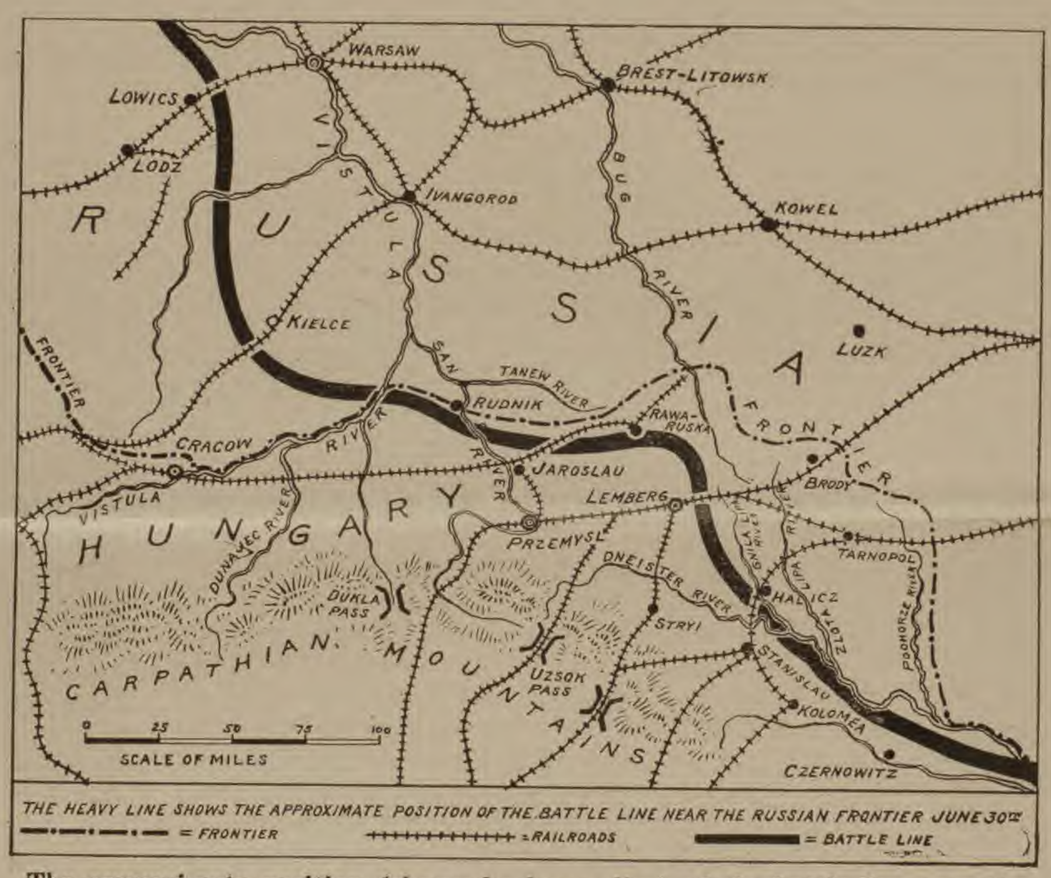
Material advantages have been obtained as well. A large friendly population that had been lost is once more available for industrial and military purposes. The agricultural area of Hungary has been materially increased before it was too late to make use of it for this year's crops, and the rich mining and oil regions of Galicia have been recovered for much needed German supply.

And yet the German victory has not been decisive. In recovering Galicia they have but won back their own country wrested from them in a previous campaign, and all Galicia has not yet been recovered. They have won many battles, but so also did the Russians when they made their victorious advance a few months ago to the southern slopes of the Carpathians. Yet the Russians were not able to prevent the German drive from Cracow, and the Germans now, in their turn, may not be able to prevent a similar counter stroke by the Russians. The truth is the present German campaign is little or no more decisive than the Russian campaign of some months ago. The Russians failed in their efforts to deliver the knock-out blow toward Cracow that would have split the Teuton army and separated the Austrians from their German allies, and to date the Germans have failed in each of their efforts to drive home a wedge that would split the Russian army.

Nothing less than the destruction or complete dispersion of the Russian army can give the Germans a truly decisive victory the effects of which might endure to the end of the war, and the masterful way in which the retreat of that army has been conducted for nearly two months indicates that its leader will go to the extreme of giving up not only all of Galicia but any amount of Russian territory as well, rather than allow his army to be broken and scattered. If we read correctly the teachings of German strategy, it aims to destroy the Russian army and considers the occupation of Russian territory of importance mainly because this will contribute indirectly to the destruction of the Russian army or of the hostile army on the western or southern front.

The Russians are past masters in the art of retreating. Their campaign in Manchuria against the Japanese was one long retreat from the Yalu to Mukden, interspersed with many battles, in all of which they were defeated, yet they fought more valiantly and ferociously at their last battle before Mukden than at any previous stand. They should be perfectly capable of repeating that performance in the present war, if Germany chooses to follow and be swallowed up in the vastness of Russia, as did Napoleon in his disastrous Moscow campaign.

The violence and magnificence of the campaign in the east has drawn our attention lately from the western front, yet for Germany it is still the all important battlefield on which the war can be most speedily decided. She turned away from this theater some months ago when dire necessity compelled her to go to the assistance of her ally to stem and turn back the tide of Russian invasion which threatened to overwhelm Austria. In strict accord with the sound principles of strategy, she adopted no half measures in this extremity, but stripped her western line to the bare necessities of defensive warfare and concentrated every available man for the speediest possible accomplishment of the task she was to undertake in the eastern theater. The really decisive campaign, the one that may end the war—the capture of Paris and the Channel ports and the destruction of the French army—has not been abandoned, and the German General Staff must be very impatient to resume it. The summer is advancing and the movement of the German army from the Russian to the French front cannot be delayed indefinitely if the western campaign is to be completed before winter sets in. Yet it would be folly to abandon the eastern front before the Russian army is so exhausted and demoralized as to be incapable of a far-reaching invasion of Austria and Germany during the continuance of the western campaign.



The approximate position (shown by heavy line) of the battle line near the Russian frontier, June 30th.

If this is the German task, it truly is a stupendous one, but the position of the long battle line on the Russian frontier appears to favor its execution. A glance at the map shows how the Russian line has been stretched more and more with each passing week. Only a few weeks ago it was well to the west of Przemysl; then it was pushed back to that fortress; a little later it was pushed back another fifty miles to Lemberg; and now it is well to the east of that city, probably along the Bug and Zlota Lipa rivers. Each of these moves to the rear has added to the strain on the stretched-out battle line which, if the process is continued indefinitely, must eventually readjust itself on a shorter line or break as would a rubber band. The Germans have so shaped the campaign as to force the Russians into a very disadvantageous position, which is rapidly becoming dangerous. From Kielce to Rawa Ruska, a distance of one hundred and fifty miles, the line runs almost east and west, beyond Kielce it runs to the northward, and beyond Rawa Ruska to the southeast. A powerful effort at Kielce or Rawa Ruska, or at some other point between the two places, if it should succeed, would effectually divide the Russian army and open the way for a decisive German victory and the renewal of the campaign against France.

The news of the week ending June 30th has not been of a character that admits of even a probable speculation as to the next important move. The Russian army has revealed greater resisting and fighting power than was anticipated, and German progress to the east of Lemberg has not been as rapid as was expected. These facts suggest the probability that movements preparatory to a blow are being made behind the German line under cover of a show of force to the east of Lemberg and along the Dniester. If this should be true the next week may have in store for us a surprise equal to the first thrust of the drive from Cracow that began the campaign. This assumes that the Germans are in no great danger as yet from a Russian offensive movement, for it is not probable that the Russian army has yet recovered its strength in men, guns, ammunition, and supplies sufficiently to make this possible.

So far as mere surface indications go, the Germans appear to be continuing their attacks all along the two hundred and fifty miles of front from the junction of the San and Vistula rivers to the Russian left north of Czernowitz. The Russians have made a most determined stand along the Dniester portion of this front, where the strong defensive line of the river has favored a stubborn defensive, apparently for the purpose of covering the orderly retreat of their forces farther north from Lemberg and Rawa Ruska to the line of the Bug and Zlota Lipa rivers. So long as the Germans were confronted on their right by a strong undefeated Russian force south of the Dniester they could not push their advance farther to the north indefinitely, and it was quite important that this force should be driven back to the north bank of the Dniester, which would thus be converted into a powerful protection for the German right flank.

In the last days of the week under consideration, the battle that raged for some time on this flank was terminated temporarily in a partial success for the Germans who captured the town of Halicz on the Dniester at the mouth of the Gnila Lipa and cleared the Russian army from an additional section of the south bank of the Dniester.

Should the Germans continue their attacks on this flank and to the north, which is more than probable, and should they meet with continued success, the tendency would be either to drive the Russians to the northeast, away from the Dniester, or else to the east beyond Tarnopol and Brody, still further stretching the much elongated line running to the east from Kielce.

From whatever angle the probable German intentions are considered it is difficult to see how the Russians can save the city of Warsaw unless they succeed in the near future in turning the tide of battle. German activity to the north of Warsaw has been attracting increasing attention, and it is well to speculate on what it may mean. We must not forget that the splendid system of strategic railways built with so much forethought by Germany is one of her great advantages over the Russians, and the present situation is particularly favorable for making good use of the system. Stirring events elsewhere have also withdrawn attention from German activities in the region of the Gulf of Riga, but we may be sure that the foothold gained here—less than four hundred miles from Petrograd—is not without a purpose.

The operations of the week on the French front were similiar to those of preceding weeks. The French offensive has increased in vigor; untold quantities of ammunition have been expended, and life has been sacrificed lavishly, but the German anvil has only been dented. The sword that is to cleave it in twain is yet to be forged. Still the French have made gains, the accumulated value of which will grow in importance if the ground lost by the Germans is not recovered. The effect of the French victories is being felt more and more on the Russian front, giving heart to the Russians and making the Germans very impatient to reach a decisive conclusion of the eastern campaign.

On the Italian front neither side made any material gain for the week unless we may consider the ability of the Austrians to stop the Italian advance, a gain from the Teuton viewpoint. Not only has the Austrian defense stiffened, but the Italians have now reached positions of greater natural and artificial defensive strength which they probably cannot take without the concentration of large numbers and great loss of life. Their aim must be to break down this first line of Austrian defense before a decision is reached in Russia.

Everywhere the conditions compel Germany to hasten the completion of the Russian campaign.

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

Combined Astronomical and Geographical Globe

To the Editor of the SCIENTIFIC AMERICAN:

Noticing your article entitled "The Heavens on a Parasol" in your issue of May 22nd, I want to suggest what seems to me a more practical system. It is to show the continents, countries, shore lines, etc. (which are so much distorted on our flat maps) on concave and convex disks representing hemispheres or smaller portion of the earth's surface. These disks could be spun up or stamped out of thin sheet metal or molded in paper pulp or *papier maché*. They would nest and take much less space and cost much less than a mounted globe of same diameter. The star clusters could be shown on the concave surfaces. READER.

Pittsburgh, Pa.

Motorboats to Attack Submarines

To the Editor of the SCIENTIFIC AMERICAN:

Just as a suggestion from a "lay mechanic" and not a designated mechanical engineer, would it not be possible to combat the submarine with a high-speed motorboat, armed with one or two small caliber rifles, firing an explosive shell.

The cheapness of cost of a 40-, 50-, or 60-foot motorboat, built strong enough to stand the strain of the firing of the gun, and the ease and quickness with which such a boat can be constructed, would, if this is possible, enable our own navy or that of the Allies to dispose of the present submarine terror.

The idea of the motorboat is that its speed and its quick turning radius would enable it to dodge successfully a torpedo aimed at it, while the explosive shell from the boat gun would so wound it as to prevent its diving, and make it an easy prey to larger craft.

New York city. C. A. PEIRCE.

The Crack of a Whip

To the Editor of the SCIENTIFIC AMERICAN:

I was reading the article in the issue of April 3rd instant, "Why a Whip Cracks," giving Prof. C. V. Boys's idea that the speed of the whip is that which produces the sound. I would like to submit the following:

I had spent some little time thinking about this, when quite a while since I was in a half-illumined harness store where the merchant happened to be trying whips. One particularly loud snap produced an electric spark at the end of the lash. All of a sudden the idea occurred to me that the snap was not made by the lash at all, but was produced *by the action of the lash dividing the air and that it was the instantaneous concussion of the air that produced the snap* and the electric spark was the friction caused by the division of the currents of air, the same as in a thunderstorm. Why not? JESSIE M. JONES.

Canton, Pa.

The "Canals" of Mars

To the Editor of the SCIENTIFIC AMERICAN:

In your issue of May 8th, 1915, Prof. W. H. Pickering is quoted as remarking that the apparent movement of some of the so-called canals on Mars does not strengthen the theory of irrigating ditches. It seems to me that the reverse is correct.

I believe it is supposed that the visible marks are the vegetation produced by irrigation and not the canals themselves. If there were not enough water available to fill all of the canals at the same time, the water would, of course, be turned in part, which would then become visible from the growth of vegetation. After a quick growing crop was produced the sluices in one canal would be closed and those in a nearby ditch opened. This would permit the vegetation along the second canal to be seen, while the first would disappear from the regular procedure of the Martian harvest operations, and the canal first seen would apparently have moved.

Vicksburg, Miss. PHILIP CRUTCHER.

An Opinion of the Scientific American From an Old Reader

To the Editor of the SCIENTIFIC AMERICAN:

Finding that you invite contributions from old readers of the SCIENTIFIC AMERICAN in connection with your seventieth anniversary, I would remark that I have been a reader of your journal with a degree of regularity for the past forty years, and that in all this time much of the material appearing in its columns has been read and absorbed by myself with avidity.

I have a distinct recollection of the time when the first McCormick reaping machine was introduced and operated in this part of the country. The inventor being a native-born Virginian, the shop where he worked out the design for his first reaping machine in 1831 was yet standing at Auburn, Va., when visited by the writer twelve years ago. In consulting my files of SCIENTIFIC AMERICAN I find on page 74 of your fiftieth anniversary number, a cut representing this machine as it was operated at Steele's Tavern, Va. This anniversary number, bearing date of July 25th, 1896, contains the prize article, "The Progress of Invention During the Past Fifty Years," by Edward W. Byrn, M.A., of Washington, D. C. At this time, perhaps, modesty would not forbid me the statement that I was one of the unsuccessful contestants for that prize.

The testimony as to the worth expressed editorially, and the splendid tribute offered by the committee on award to all contestants, gave ample recognition as to merit in each case; and it may not be thought presumptuous in me to add that the files of your journal have served me as a rich and most resourceful fountain of knowledge to draw from in the preparation of the thesis that gave the writer his M. A. degree in college.

Dale Enterprise, Va. J. P. HEATWOLE.

A Plan for Methodical Increase of the Navy

To the Editor of the SCIENTIFIC AMERICAN:

Your correspondent begs to present briefly a suggestion for organized naval construction, with a view to remedying the patent defects in our naval arm.

It would seem valuable to organize the fleet on a permanent system, somewhat parallel to that of the Army, i. e., in units composed of elements in fixed proportion.

To this end I suggest the squadron as the unit to be composed approximately as follows: Four battleships, one battle-cruiser, four light cruisers, twenty destroyers, and auxiliaries necessary to render the unit independent. This unit would be commanded by a rear-admiral.

Two squadrons form a division under the flag of a vice-admiral. Two or more divisions form a fleet under an admiral's flag.

I merely suggest the latter superior formations to indicate the necessary creation of superior flag officers; obviously tactical consideration might demand a departure from the established organization.

Each squadron may be considered to require 10,000 men.

Given our present rate of new construction—two battleships yearly—under the suggested system Congress would appropriate biennially for an additional squadron.

This automatically provides four battleships, one battle-cruiser, four light cruisers, twenty destroyers, the required auxiliaries and a *maximum* increase in the enlisted *personnel* of 10,000 men, together with the admission to the naval academy of the necessary officers.

I have noted the increase in enlisted *personnel* at a *maximum* of 10,000 men; it is considered to provide for the manning of the projected ships. Obviously the squadron increase may be determined at a lower figure, due to laying up of ships in reserve and the striking out of obsolete vessels, tending to release for new service a proportion of the men already enlisted.

This system, similar in effect to existing continental naval practice, should secure homogeneous units—always invaluable tactically—and would remove from lay interference (however well intentioned) the question of composition of the fleet, presumed under this disposition to be determined by law from recommendations of the professional naval boards.

Flexibility as to increase or decrease in rate of construction is secured by variation in the interval of appropriation. This is so apparent as to need no demonstration. WM. BERGEN CHALFANT,

Building Bureau, Carnegie Institute of Technology.

Pittsburgh, Pa.

A Plan for Increasing Our Military Strength

To the Editor of the SCIENTIFIC AMERICAN:

Military preparedness or unpreparedness by the United States has now become a vexed and burning question. Measures and resolutions of various kind and character bearing upon this important issue have been discussed by the national law-making body; newspaper and magazine editorials, personal comment and criticism, materially aided by the expressions of the SCIENTIFIC AMERICAN, are clearly indicative of the attention demanded by the military necessities of the nation, and it is devoutly to be wished that from out the *olla podrida* of pending discussion and threatened legislation some capable, satisfactory and efficient method of military improvement may be evolved and crystallized into action. Such a consummation would permanently remove the suspicion, now all too prevalent, that, as a nation, we are incapable of military offense or defense.

Granting the honesty of purpose, the sincerity of intention of the advocates of "peace at any price," it must be admitted that the advice of George Washington is as potent to-day as when it was given. Those who advocate peace with a concurring lax military system are, very evidently, swayed by mere sentiment rather than by the reason of the subject. One year ago the world was at peace, save a few incipient revolutions in the Latin-American republics. One year ago no nation dreamed of war. Now the blood-stained, battle-scarred nations of Europe give solemn warning. Is not eternal vigilance still the price of liberty? We all deprecate wars of aggression or of conquest, but wars in defense of the home, wars in defense of liberty and right, carry with them an air of sanctity. It was only through war that our forebears wrested political liberty from the reluctant hands of tyrants. It was only through war that the American nation was enabled to maintain its political unity. If these rich blessings are to be perpetuated and enjoyed, then we must be prepared to defend and protect them against all the nations of earth. The sword is just as sacred a weapon in the hands of the American citizen of to-day as it was in the hands of his revolutionary forefathers, or of those heroic souls who fought through our civil war until human fortitude could no longer go.

President Wilson, in one of his messages to Congress, enlarged upon our means of national defense through the medium of what he termed the "citizen soldiery"; but we have no "citizen soldiery" in a literary sense, for a mob is not an army. An army must be made up of trained soldiers and that training cannot be accomplished in a day. It has been well said that "a soldier on the firing line who does not know how to shoot makes better material for a coffin than he does for a fighter." The real difference between peace and war lies in our condition of preparedness or the lack of it. What the nation most needs is a self-consciousness of our ability to protect ourselves from war or against war. Properly trained men and the necessary machinery are the essentials to secure that self-consciousness. To wait until an armed foe is at our very gates and then place reliance upon a "citizen soldiery" is both dangerous and suicidal. It would mean the needless sacrifice of thousands of men. Dependence upon a "citizen soldiery" untrained and unskilled in the great game of war would necessitate a long detention in concentration camps, the enemy, meanwhile, gathering in force.

I would suggest the following plan for increasing our military strength:

Convert the National Guard, by Act of Congress, into a purely national organization and for federal purposes only.

Relieve the National Guard, by Act of Congress, from the necessity of performing police functions in behalf of the States, except under Federal authority and control.

Place the enlisted and commissioned *personnel* of the National Guard under pay proportionate to the duties required of them and according to grade.

Amend the Federal military law so as to make the National Guard in reality the first army reserve, subject to the orders of the President and Secretary of War at all times and in all places.

Remove the legal restrictions against the use of the National Guard in active service on foreign soil.

Allow the National Guard to elect its own company, battalion and regimental officers from a list of duly qualified candidates, brigade and division officers to be of the Regular Army.

Demand the same duties, proportionately, and responsibilities of both officers and men in the National Guard as are now demanded of officers and men in the Regular Army.

Place the National Guard under the provisions of the Army Regulations concerning military offenses.

Provide an abundance of Regular Army officers as instructors and supervisors.

Keep the National Guard well armed, equipped and uniformed, and require general efficiency in their particular branch of the service.

Provide for battalion, regimental, brigade and division maneuvers with regular frequency for purposes of general instruction in all tactical as well as administrative units.

With Federal legislation of the character suggested thousands of available young men would take advantage of the opportunity to acquire a military education and a wholesome regeneration of the National Guard in all the States of the Union would speedily follow. The utilization of the Regular Army officers for instruction purposes would create a feeling of kinship between the two organizations and existing antagonisms would disappear. This trained reserve could be mobilized in any emergency and upon exceedingly short notice. The republic could then rest secure in the knowledge of being prepared should it be confronted with war.

Happily, I am not indissolubly wedded to the above plan, and can be readily divorced therefrom provided a better plan can be suggested. The National Guard offers a nucleus for that trained reserve now so universally insisted upon and the training could be given without drawing the individuals from industrial pursuits. JOHN R. CHARLESWORTH.

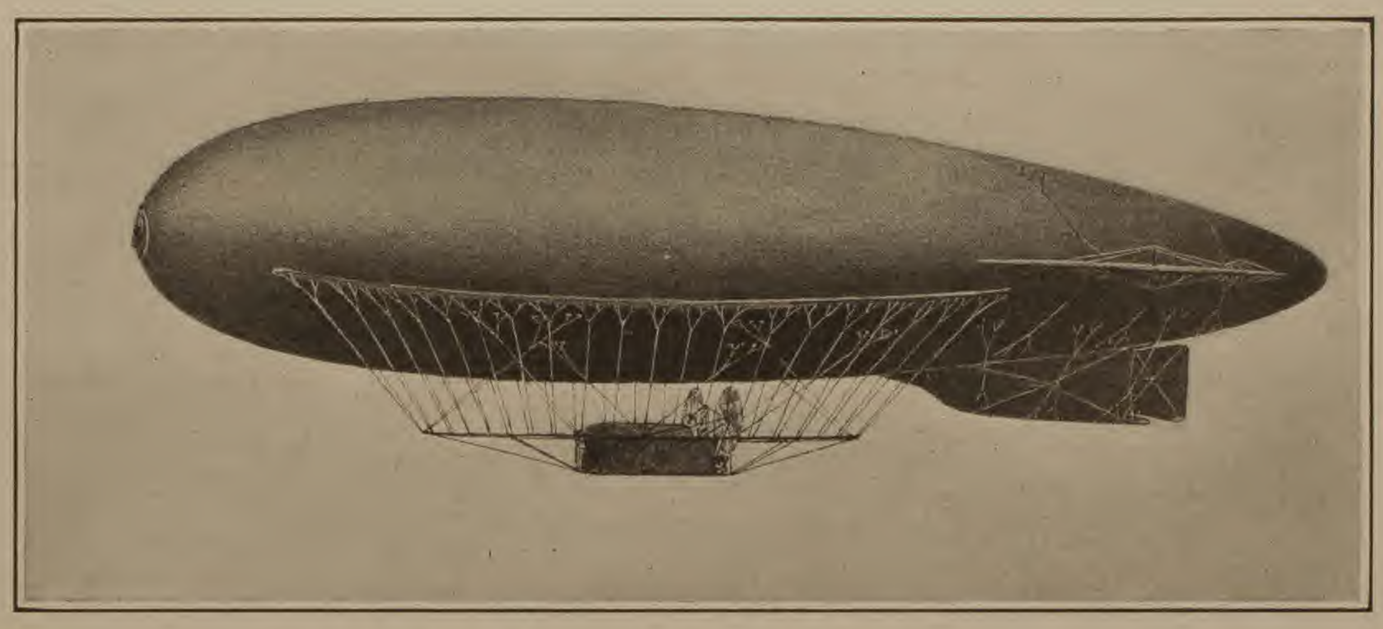
Captain Second Infantry, N.G.C.

Our First Naval Dirigible

An American-built Airship Possessing Novel Features of Control and of Anchorage

By C. Dienstbach

THAT the contract for the first United States naval dirigible has been awarded to the same constructor who seven years ago supplied the first United States army dirigible, Capt. T. S. Baldwin, co-operating with the Connecticut Aircraft Company, is well in keeping with the policy of developing home resources, which furnished the keynote of the Navy Department's recent dirigible competition. Experience has proved nowhere a more valuable asset than in dirigible development, especially if the problem involves enlisting all sorts of "odds and ends" of established industries to form a new, and not only passing expert judgment upon ropes, fabrics, woods, wires and what not concerning fitness for dirigible construction, but also knowing where such precious "by-products" of current commerce may be procured. The accepted design bears proof that the winner of the competition has also not only taken advantage of seven years of astounding progress in Europe, but has also availed himself of that most efficient help to inventors, the modern aerodynamic laboratory, which, thank goodness, is no longer missing on this side of the ocean. Self-evidently the shape of the hull is thus a striking improvement on the Army dirigible of 1908. The exacting conditions of the naval authorities have, furthermore, in this case happily resulted in refinement of design rather than (as might generally have been feared from an approach to the British type) the reverse. The Navy's demand that the car could float has eventually turned Capt. Baldwin's original Renard-Santos Dumont-Astra type into an improved Austrian Körting type, for the frame is now made quadrangular only one third of its length, and this part is fashioned into an inclosed boat. The other two thirds are, as in the "Körting" (and in the best biplane practice) made of only a minimum number of steel tubing-struts which could be arranged at a sharp angle with the path of flight, and forming triangles, dispense with bracing wires. Consequently their head resistance compared to the regular forest of numberless struts and wire braces at right angle to the path of flight in an old-fashioned Santos Dumont-Astra frame has been immensely reduced, while that of the inclosed boat hardly counts. A certain relative increase in weight is thus more than offset.



A 175-foot dirigible for the United States Navy.

Storm-proof system of anchoring the dirigible.

It may not yet be as generally known as should be expected, at this date, that laboratory tests show many small parts together offer so much more grip to the wind than few larger ones, that the whole immense bulk of a balloon, about whose "hopeless unwieldiness" some uninformed people still continue to harp, offers only one third as much resistance against propulsion as the infinitely smaller looking car and suspension. There are many interesting, up-to-date details in the new Baldwin design, such as the secure yet easily detachable fastening of the suspension to the bag by wooden toggles which are slipped into pockets of a reinforced belt; maneuvering and safety valves at the bottom of the envelope; subdivision of the envelope into four compartments communicating at their lowest part; two spherical ballonets attached with ropes to the ceiling and sewn to the floor of the envelope to keep the air from shifting.

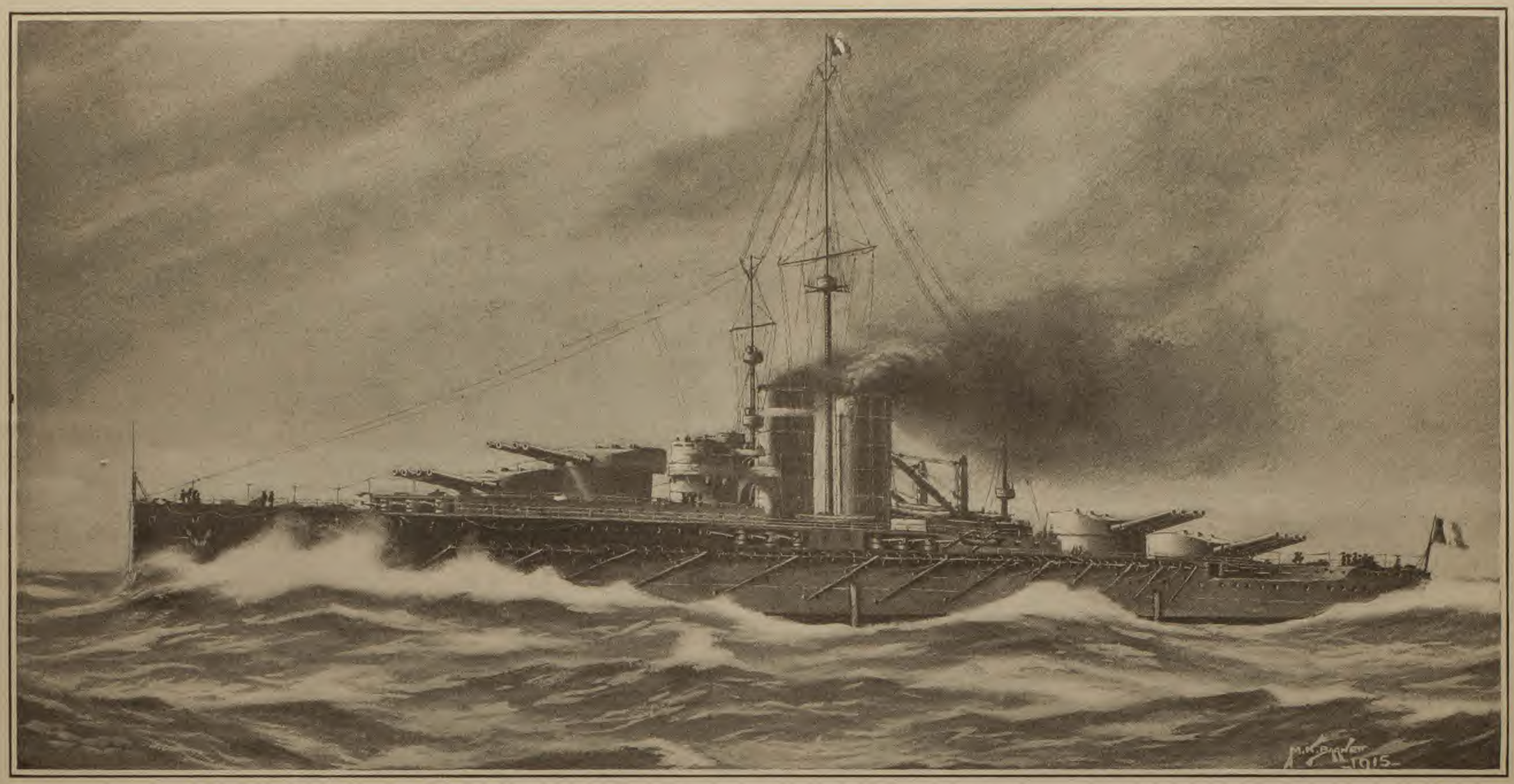
The car is hung rather close to the bag, further reducing suspension resistance. Two interesting leaves have been taken out of current aeroplane practice (so far the more familiar one in America). One is mounting only one motor of 120 horse-power, driving two propellers by chain transmission in place of two of sixty, which recalls a favorite argument of Orville Wright against multiple small motors. The other is combining two steering functions in one wheel—as in a boat, turning the wheel steers right or left, but as in an aeroplane pulling or pushing the wheel steers up or down. There are two sides to this question. The two separate helms for steering up and down in Zeppelins and Parsevals serve a very useful purpose when in badly disturbed air the helmsmen are often bathed in perspiration from the effort of keeping the ship in a reasonably steady course in either direction, and find it more than a boon that each is charged with only half the work. Yet Kipling describes in his inspired aeronautic novel, "With the Nightmail," how, facing the worst of a storm, the captain deliberately united all the controls under his own hands.

Whenever not only stabilizing, but also quick maneuvering, is essential, as in keeping up the speed and obedience to the helm of the present type of aeroplane in dangerous air, or, for instance, in dodging attack with a war dirigible, combined vertical and horizontal steering is called for. Though a dirigible is comparatively immune to the air conditions which, but for the pilot's intense watchfulness, would play havoc with an aeroplane, a combined helm might prove useful in difficult landings or in hugging the ground, especially in misty weather. ("Parseval III," while availing itself of the frictional retardation of wind velocity next to the ground to make headway in a storm, once barely missed running into a flock of cattle with its ponderous car.) But, after providing such combined helms in duplicate, steering may be both co-operative or individual. With experience in keeping captive balloons for many weeks in service in the open without any shelter (an instance which the writer used in the *American Aeronaut* six years ago to show how unjustly dirigibles have been likened to soap bubbles), Capt. Baldwin has interested himself especially in the naval authorities' meritorious demand that the dirigible contracted for could weather a 50-mile gale at anchor in the open (a vital question in this country with its scarcity of sheds). He has worked out this problem more thoroughly than it was ever tackled before. The most important detail is his way of fastening the mooring cable to the very nose of the envelope. This is beyond dispute the best point of attachment, which best coincides with the center of resistance in keeping the ship strictly head to the wind. But the difficulty arose of transmitting the jerky strains caused by irregular gusts evenly to the whole envelope. This is met by a system of suspension ropes toggled to a strongly reinforced belt that runs in a fairly wide circle around the nose of the gas bag. The crow's feet, of course, move and slip as freely in evenly distributing the pull of many to fewer ropes as those of the main suspension. But these fewer radiating ropes are by no means, as might be suspected, spliced into a common mooring cable. Instead, they are attached to a yoke, which is in turn held to the mooring rope by a bridle. The ropes are not tied to the yoke, but run over a series of pulleys at either end, yielding to any individual jerking and always resisting collectively. The mooring cable, again, is not tied to the top of the mooring tower or aerial anchoring buoy, but it merely runs over a pulley (so mounted that its axis may turn in any direction) and then vertically down to an anchorage sunk below the ground in a block of concrete.

Although this tower, illustrated by the writer in 1909 in *McClure's Magazine* and now prescribed by the military authorities, is in itself a guard against the dirigible's being dashed against the ground by vertical gusts, protection has been made yet more complete by suspending heavy ballast bags on long ropes from the ship. Whenever the dirigible is jerked down, their weight is immediately borne by the ground and an equal amount of gas buoyancy resists further vertical wind pressure. (In the writer's illustration mentioned a heavy guide rope is shown, serving the same purpose.)

The principal dimensions of the new Baldwin dirigible are: Length, 175 feet; greatest diameter, 35 feet; displacement, 110,000 cubic feet, which, most fortunately, exceeds "Vedette" size.

New Gas Lamp.—Incandescent mantle gas burners are now made as high as 1,000 to 5,000 candle-power, but hitherto it appeared impracticable to mount them at a great height above the ground upon poles, although a great advantage is thus secured from the well-known fact that a single large lamp gives better light than its equivalent in numerous small lamps. For public lighting such a lamp must be mounted at a high elevation, which prevents cleaning of the lamp and replacing of the mantle. The problem appears to be solved by a patented device now in successful use in some cities on the Continent. The lamp is mounted over twenty feet high, and can be let down for cleaning. The pole is of hollow steel tube of great strength, being curved over at the top in order to suspend the lamp, this being hung upon a cable which runs through the pole, and to a winch inside the pole base. The success of the device depends on the method of gas coupling between the lamp and its support. On top of the lamp is a cone which fits into a conical socket in the end of the pole, so as to make a gas-tight joint; and suitable means are used to make an automatic connection, so that the gas lamp can now be lowered and then re-mounted. A valve inside the pole base turns off the gas on lowering the lamp. The operation of raising and lowering resembles what is familiar for arc lamps. As to lighting the gas lamp, it can be done by a cerium friction tablet, or by a small pilot lamp which is constantly fed by a flexible metallic tube.



Displacement, 29,500 tons. **Speed,** 23 knots. **Guns:** Sixteen 13.4-inch; twenty-four 5.5-inch. **Torpedo Tubes, 6.**

The new French dreadnought "Tourville."

The New French Battleship "Tourville"

The First Dreadnought to Carry Sixteen Guns in the Main Battery

By M. K. Barnett

MUCH interest has been aroused throughout the United States over the launch of the powerful battleships "Pennsylvania" and "Arizona;" but the development of the battleship type is still progressing. Particulars have come to hand of the new French 29,500-ton battleships of the "Tourville" class, which include the "Duquesne," "Lyon," and "Lille." Out of five different sets of plans submitted to the French Ministry of Marine by the Construction Bureau, the one selected was in appearance unique, but in armament an improved "Normandie."

As will be seen in the plan, the funnels, conning tower, bridges, etc., are massed together amidships. The arrangement of gun positions is similar to that of the "Michigan," the first dreadnought to adopt that disposition of four turrets which is now universally recognized as being ideal, viz., two forward and two aft, the inner turrets raised so as to superfire over the extreme turrets. This disposition in the case of the "Michigan," gives a fire of four guns ahead, four guns astern, and eight guns on either broadside.

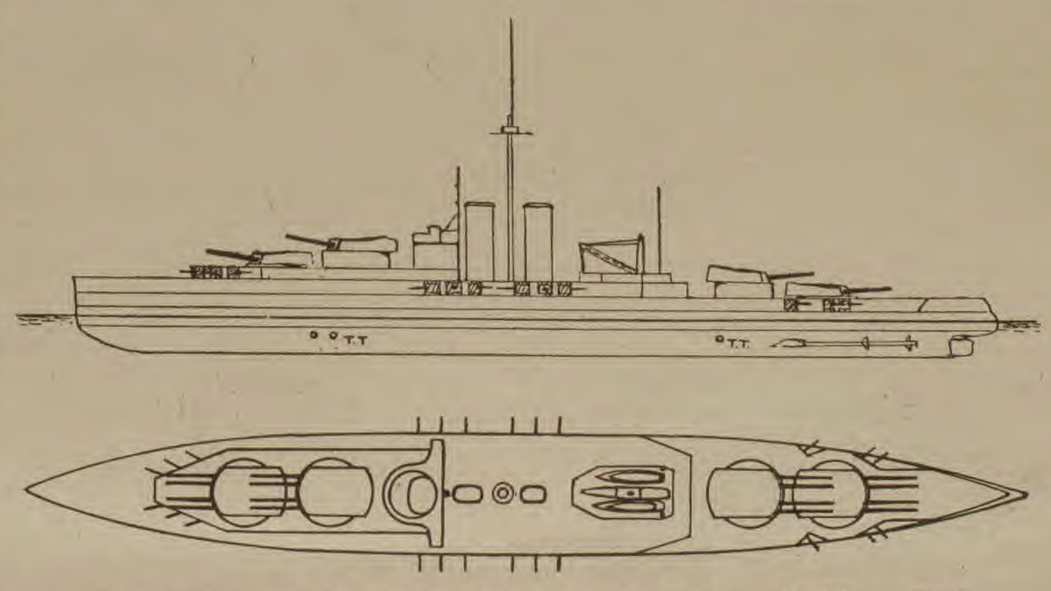
Since the "Michigan" was designed the development of gun mounting has introduced first the triple and now the quadruple turret, i. e., a turret which mounts four guns. The "Tourville" carries four of these, and hence she carries the enormous armament of sixteen heavy, armor-piercing guns of 13.4-inch caliber.

When dreadnoughts first became general, the twin turret was universal. It was Italy, whose naval designers have for many years shown great originality and enterprise, who first mounted three 12-inch guns in one turret. This novelty was incorporated in the "Dante Alighieri" (laid down in 1909), which mounted twelve 12-inch guns in four turrets. As is noticeable in all innovations, this triple mounting met with a hail of criticism; but it vindicated its existence, for it was soon adopted by Austria, and later by America and Russia, while France, together with Britain, Germany, and Japan, retained the double mounting.

In 1913, France, without having adopted the triple turret, laid down the "Normandie," which mounted three quadruple turrets, another innovation. The best evidence as to its success is that the "Tourville," the first ship of later class, still uses the quadruple mounting, an extra turret in this class giving an immense preponderance of gun power over the "Normandie."

The principal arguments used against the triple and quadruple turrets are as follows: 1. The inclusion of more than two guns in a turret incurs crowding, which is detrimental to accuracy of fire. 2. A shot jamming a turret may put three or four guns out of action; or in other words it is "Putting all your eggs into one basket." 3. The great massing of weight engendered in this principle necessarily brings more stress on the ship than a more extended disposition.

While in answer, the following arguments may be quoted: 1. The smaller the number of turrets, the easier it is to work them. 2. Although a lucky shot may dispose of three or four guns, this is compensated by the great numbers which can be mounted by this method. Or in the case of the "Tourville," a shot fouling one turret would still leave twelve big guns intact. 3. The saving of weight is greater in twelve guns mounted in three or four turrets than in twelve guns mounted in six turrets.



Side elevation and deck plan of the French dreadnought "Tourville."

No attempt is made here to solve this weighty problem, but merely to give some idea of the controversy existing on the subject.

Reverting to the "Tourville" herself, we find that she is given the unprecedented armament of sixteen 13.4-inch guns, in four turrets. In addition to the fact that her 13.4-inch weapons are compared with 12-inch guns, the ahead or astern fire of the "Tourville" is equal to the total broadside of the earlier dreadnoughts like the "Michigans," "Bellerophons," or "Nassaus."

As in the previous "Normandies" the secondary armament consists of twenty-four 5.5-inch guns, mounted in four groups of three on either broadside. The total broadside weight of the "Tourville" is about 24,840 pounds (including the 5.5-inch guns). In addition to these, six submerged torpedo tubes are installed, two on either broadside about in the wake of the space between the first and second turrets, and one on either broadside below the third barbette.

Details as to armor are not yet available; but she can reasonably be expected to have at least as heavy armor as the "Normandies" which have a belt 12¾ inches thick amidships, tapering to 7 inches forward and 7 inches aft, the belt ending a little distance from the stern.

As regards protection against submarines, the framing behind the armor is extremely massive and heavy, while a special arrangement of bulkheads has been fitted after extensive tests. The "Tourville" is designed for 23 knots.

Ignition Cables

A POINT which is too often overlooked is the matter of the quality of cables for high tension spark plugs, and this is often responsible for losses of current which occasion misfires and irregular working, which is supposed to be due to carbureter, magneto or spark plugs. One of the leading Paris magneto constructors calls attention to the trouble which can arise by neglecting the current cables, and at the same time produced a new safety cable of extra high insulation which is now giving excellent results. It has a diameter of only 7 millimeters (0.28 inch), but carries five insulating layers instead of three as in the usual types. Such layers are put on by a winding process and not by drawing, and this is claimed to increase the density and homogeneity of insulation. The inner rubber layer is not vulcanized in this case, so that there is no danger of alteration of the metal conductor by action of sulphur. Perfectly pure rubber is used, which contains no foreign matter such as produces a blackish aspect in usual cables, so that there is no fear of hardening or cracking of the insulation, and the result is a perfect insulation which lasts for a very long period.

Orville Wright Receives an Honorary Degree.—At the eighty-ninth commencement of Trinity College, at Hartford, Conn., the honorary degree of Doctor of Science was conferred upon Orville H. Wright. Another recipient of an honorary degree on this occasion was Governor Holcomb of Connecticut.

Not a subway, but a sewer made necessary by the new subways.

The work at Broadway and Canal Street and connections with existing lines. Masses of

Railroads Under and Over the Streets of New York—I

Difficulty of Excavating Subways Through the Heart of a Big City

FIFTY years ago when the question of having a subway in New York was first agitated, Alfred W. Craven, who was the chief engineer of the Croton Aqueduct, came out flatly against the proposition on the ground "that the proposed underground railway beneath Broadway would cut the main artery of the water supply system; that during its construction the water must pass through side pipes which would not supply the wants of the inhabitants; that no water would be available for extinguishing fires; that factories must be stopped and the damages accruing as the result would be enormous, say, not less than one hundred million dollars." He declared further "that any tunnel excavation by blasting, even at a depth of ten or fifteen feet under the water pipes would injure the joints of the pipes by concussion." The irony of fate may be seen in the appointment of this man's nephew and namesake, Alfred Craven, to the position of the chief engineer of the Public Service Commission, which is now adding over fifty miles of new subways to the system that has already proved its success.

If we would measure the increased facilities that will be afforded by the lines now building or recently completed we must consider track mileage rather than line mileage; for capacity is an even more important factor of a rapid transit line than length. The existing subway covers seventy-three miles of track, of which about sixty are underground. The new lines will add nearly one hundred and fifty miles of underground track. But we cannot separate underground from overhead railways, because all the subways break out of the ground at one point or another and are continued as surface or elevated structures. Furthermore, under the Dual System contracts they are interconnected with the existing elevated lines. Considering then the entire rapid transit system of Greater New York we find that the existing lines contain 296 miles of track, to which new lines will add 324.9, making 620.9 track miles. This does not include 7.1 miles of the Hudson and Manhattan Railroad, which is not embraced in the Dual System.

By the terms of the Dual System contracts, it will be recalled, the rapid transit system of New York is apportioned for operation between the Interborough Rapid Transit Company and the Brooklyn Rapid Transit Company, the latter operating its new lines under the name of the New York Municipal Railway Corporation. But popularly the two systems are known as the I. R. T. and the B. R. T.

The accompanying map shows just how the territory has been apportioned between the two companies and what new lines are being added, but it does not show the miles of third track added to elevated lines, which, because it will carry the tide of traffic during rush hours adds far more than fifty per cent to the capacity of the elevated railroads. The Dual System will increase the transportation facilities of Manhattan above Fifty-ninth Street, three-fold and below that point, five-fold. Three new tunnels will be constructed under the East River and one under the Harlem River (now practically completed), while the Steinway tunnel, built long since and just opened for traffic, will form part of a new line running from Times Square to Long Island City, connecting there with elevated lines extending to Astoria and Corona.

The accompanying map tells more than pages of description, but it may not be amiss to refer to the so-called "H" system of the I. R. T. Trains coming down Broadway to Forty-second Street will continue down the west side under an extension of Seventh Avenue, while trains running up Fourth Avenue to Forty-second Street, will continue up the east side under Lexington Avenue. These form the two legs of the "H," while Forty-second Street is the cross bar, and here shuttle trains from Times Square to the Grand Central Station will enable passengers to transfer from the western to the eastern line and *vice versa*.

Engineering Work.

Never has there been an engineering undertaking that could compare with the work now going on in New York, in difficulty and variety of knotty problems encountered. There is work in soft earth, in gravel interspersed with bothersome boulders, in quicksands, in the beds of old streams long buried, but still permeated with water to such an extent that the subway construction must be weighted down with masses of concrete to keep it

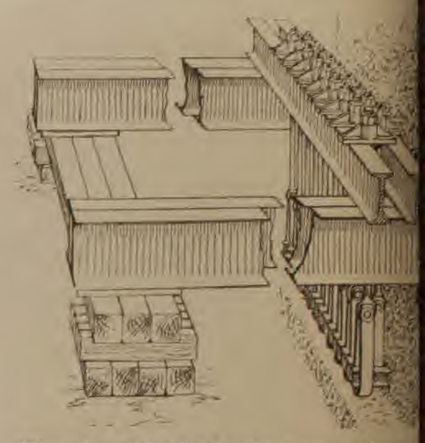


Fig. 1.—Method of suspending

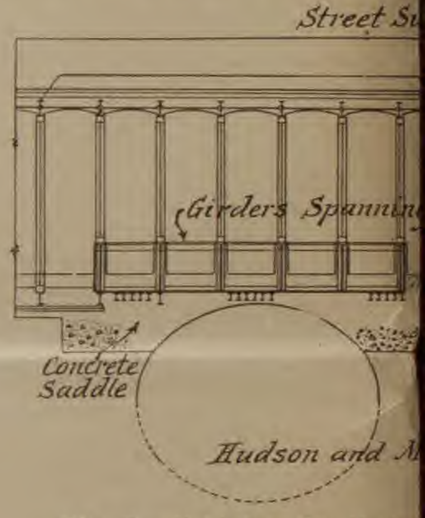
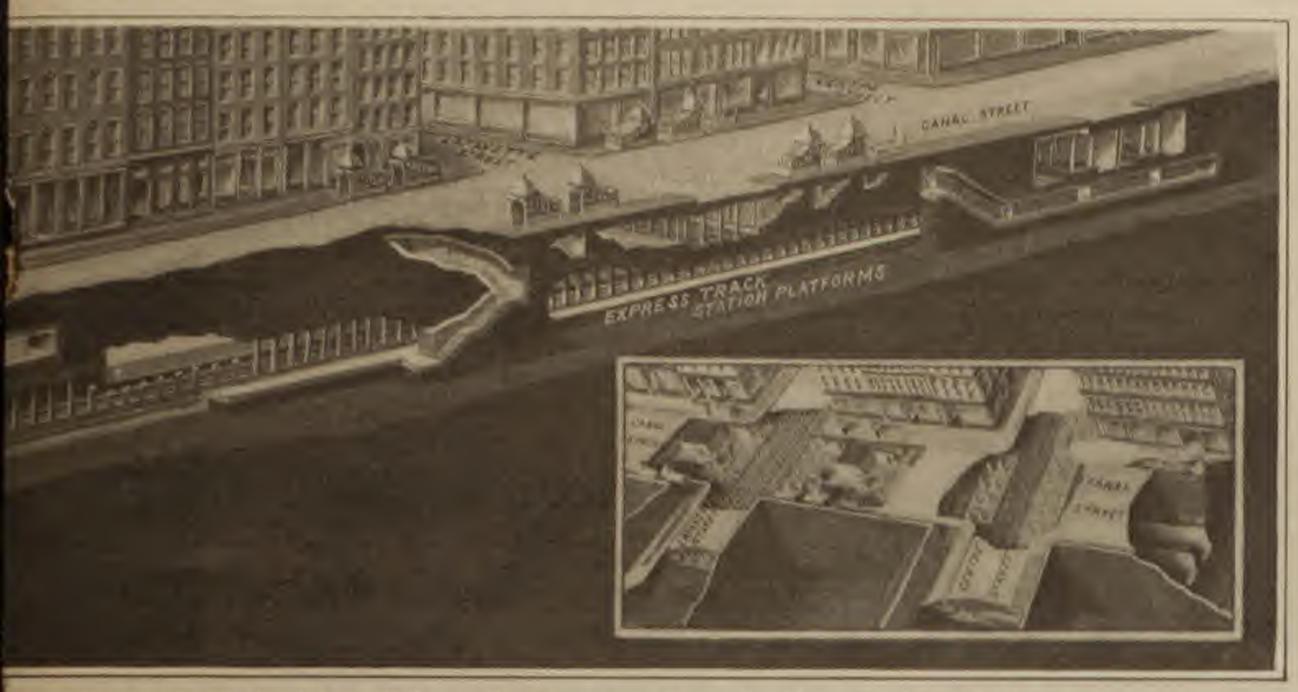


Fig. 2.—Bridging the Hudso

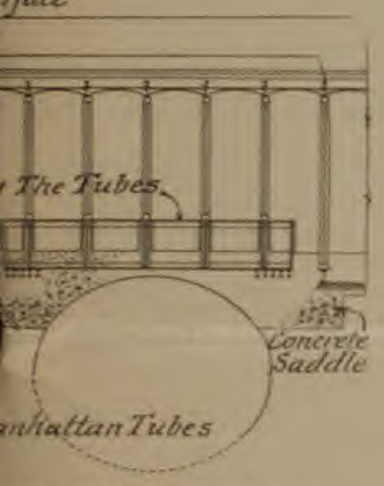
Pumping out the excavation at Canal Street and Broadway.

Map of the new and existing rapid transit lines of New



concrete shown at the left will keep the structure from floating up through the street.

he foundations of a building.



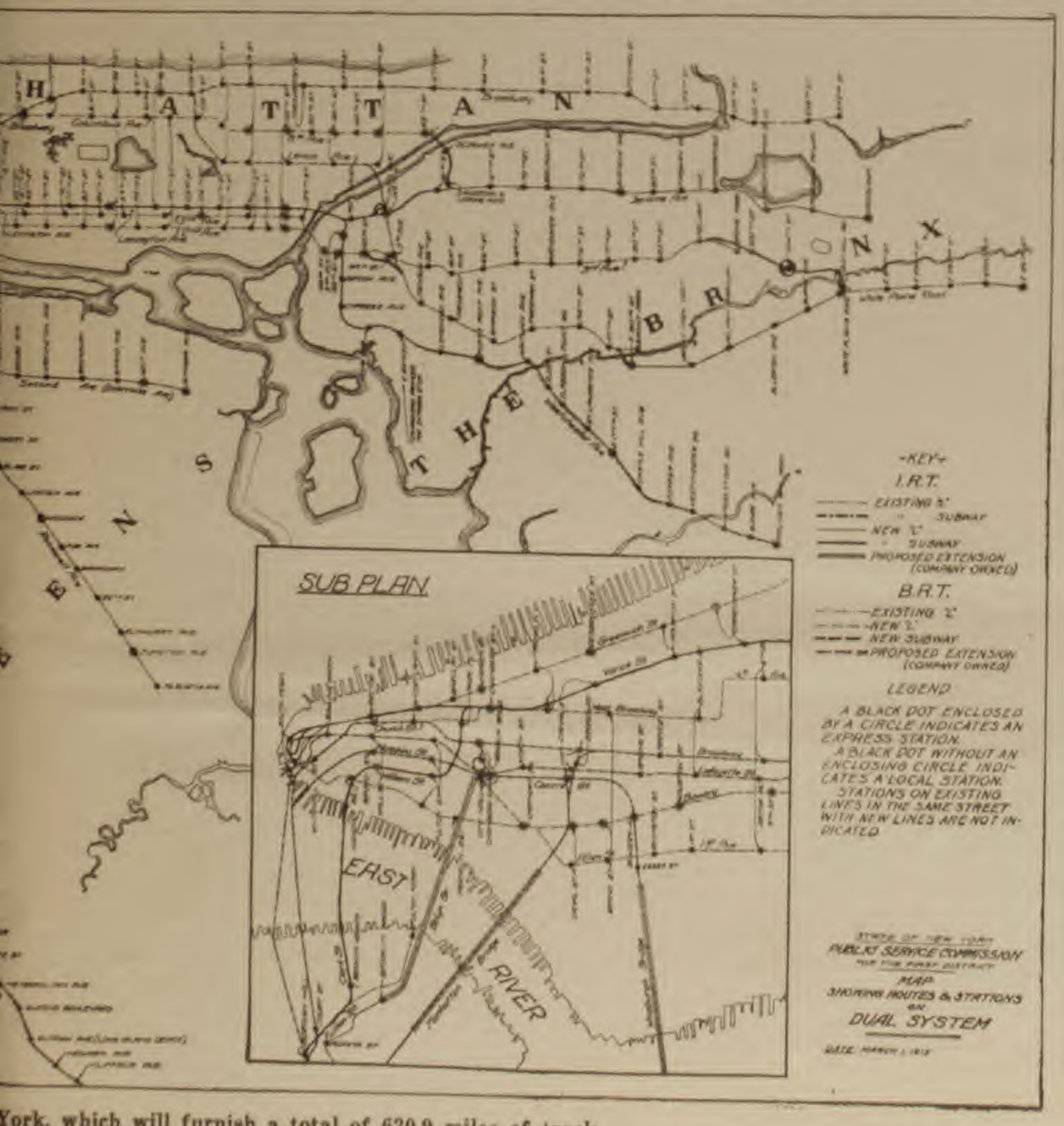
n and Manhattan tubes.

from floating up out of the ground. Then, on the other hand, there is work in hard rock that must be drilled and blasted, in disintegrated rock that may be productive of slides and in seamy rock with the strata running at a sharp angle or even vertically, so that they must be supported by timbering to prevent disastrous slides. There are ticklish crossings, over, under and between existing lines, and, in order to avoid grade crossings, there is a point where the subway twists upon itself after the manner of the corkscrew.

Any connected story of the entire work would be far too lengthy for these columns. We can merely refer to a point here and there that stands out prominently above the rest. They will be taken up under the following headings: The work under foot; the work under water, and the work overhead.

The Work Under Foot.

Previous articles in the SCIENTIFIC AMERICAN have described the cut and cover method of subway excavation, explaining how sections of street paving are torn up during the night hours when the streets are practically deserted, and replaced with a decking of heavy planks, so that workmen can burrow under this cover without disturbing traffic, putting in posts or columns to support the decking as the excavation proceeds. The present work has developed one or two important improvements in methods of supporting the decking. Our cover illustration this week shows a system which does away with the forest of timbering heretofore required. Timber towers are set up directly under the car tracks, about forty feet apart, with brackets extending to each side and meeting similar brackets built out from the sides of the excavation. On these brackets the street decking is supported. The excavation proceeds from the foremost tower by the use of a cantilever system to support the street until the next tower can be set in place in the new cutting. A series of beams are carried on the towers, one pair being 120 feet in length, so that its rear-



York, which will furnish a total of 620.9 miles of track.

Building on Lexington Avenue temporarily supported on jacks.

most extension blocked under the decking already laid, may serve as a counterpoise for the work carried on ahead.

The construction of a subway under the streets of New York calls for an amazingly large amount of subsidiary work. Close under the streets there is a vast system of pipe lines and conduits interlaced in a seemingly inextricable mass, which must be maintained undisturbed. To remove all danger of gas leakage in the cut the gas mains are taken out of the excavation, and carried on trestles over the sidewalks, while the mains for local service are placed along the curb on the street surface.

Reconstruction of Sewers.

Cutting close to the surface the subways intercept many sewer mains and require an enormous amount of reconstruction. Fifty-four miles of sewers are being rebuilt or replaced with new lines. In one place a new sewer a mile long is being dug down Thirtieth Street to the North River. In several places inverted siphons have had to be constructed to carry the sewage under the subway.

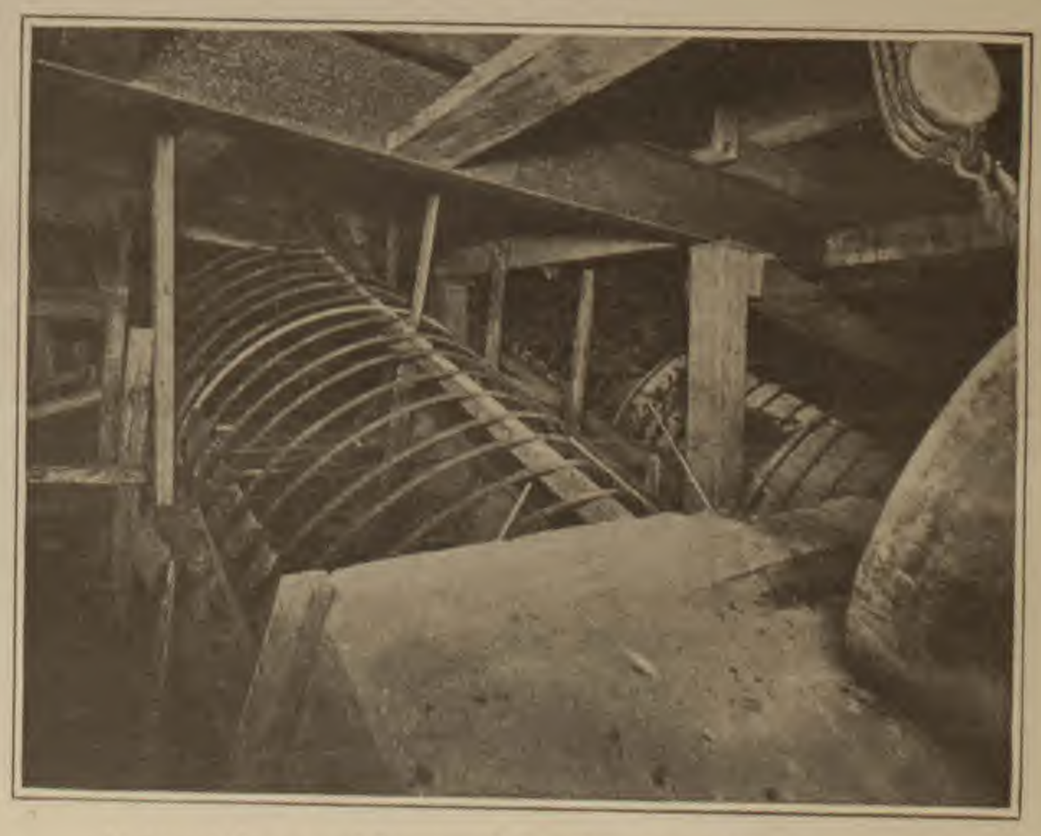
In this connection it is interesting to mention a place on Fourth Avenue, Brooklyn, where the city was rearranging the sewer system, and expected to dispense with a stretch of sewer, running from Atlantic Avenue to Butler Street. According to the original plan the new sewer system was to be completed in plenty of time to permit of building the subway up Fourth Avenue at that point. But there was a hitch that delayed matters until the subway work was well along at this point, with the big fourteen foot brick sewer running right up the center of its course for a distance of 2,000 feet. Instead of stopping the subway work, however, it was continued until one of the track sections was completed, when this was promptly converted into a temporary sewer. In other words it was inclosed and provided with an inverted-arch floor; then a siphon was built connecting the downstream end of this temporary sewer under the line of the Fourth Avenue subway with the sewer running down Butler Street. This done, the sewage was diverted from its old brick conduit and run through the subway section, permitting the rest of the subway to be completed.

Underpinning Buildings.

Building foundations give the subway contractor a deal of trouble. Where the subway cut is deeper than the adjacent foundations there is always the danger of a slide, even when the foundations are built on rock, because much of the rock is very soft and seamy. Often the foundations themselves are poorly constructed. An extremely difficult situation is to be found down town, along the William Street line, where tall and heavy buildings abound. Strange to say, only three buildings are built on foundations that have been carried down to rock by means of caissons. Practically all the buildings along this line must either be supported temporarily while the subway passes them or else be provided with new foundations carried down to subgrade of the subway line. The contractor who is building this portion of the subway is charging nearly as much for underpinning as for the actual excavation.

A very interesting example of underpinning is to be found in Brooklyn, where an eight-story telephone building is being temporarily supported during the construction of the subway past its foundations. The columns of this building rest on a grillage of I-beams embedded in a mass of concrete. As the sub-grade of

(Concluded on page 52.)



An inverted sewer siphon running under one of the new subways.

Systematic Observation of Meteors

An Opportunity for the Amateur Astronomer

By Prof. S. A. Mitchell, of the Leander McCormick Observatory

WHO of us is not familiar with the darting rush of light through the sky which we call a shooting star, or in its more splendid forms, a meteor or a fire-ball? Some of these objects are so faint that they are glimpsed only out of the corner of one's eye; some are so bright that they illuminate the landscape, and so close that the noise is heard as they explode into fragments. The popular impression regarding meteors is that they fall in haphazard fashion, obeying no laws, and consequently, study of them would be futile. As a matter of fact, their systematic observation furnishes the amateur with a splendid opportunity to do work of great scientific value, and this may be done without an expensive equipment and almost without previous training.

The amateurs in astronomy undoubtedly vastly outnumber the amateurs in any other science. There is a great fascination about observing the moon, or Saturn, or watching a double star like β Cygni with striking differences in color. The beginner feels greatly elated when he first obtains his three- or four-inch telescope. He picks up, one after the other, the familiar objects in the sky, and takes particular delight in showing them to his friends. He generally finds, however, that the novelty soon wears off; there is no convenient place for setting up the telescope, clouds interfere, and as the winter comes on, the weather gets raw and the cold penetrates. And so, little by little, the enthusiasm dies out—and soon there is a second-hand telescope for sale.

Fortunately for science, the human mind is constituted in such a fashion that no task is too long to tackle provided that the results to be obtained are of value. The tried astronomer can keep up his enthusiasm through a long night at the telescope with the temperature twenty degrees below zero, because he has the feeling that he is adding something to the sum total of human knowledge. It is the lack of purpose in the work of the amateur that causes him to lose his interest and neglect his telescope. If the beginner could feel assured that his work was of value, he would cheerfully endure the cold, the discomfort and the lack of sleep. Many years ago in Chicago, an amateur started to observe double stars; and Burnham made of himself the greatest double star observer the world has ever known.

Photograph by Barnard of the Milky Way, showing a meteor.

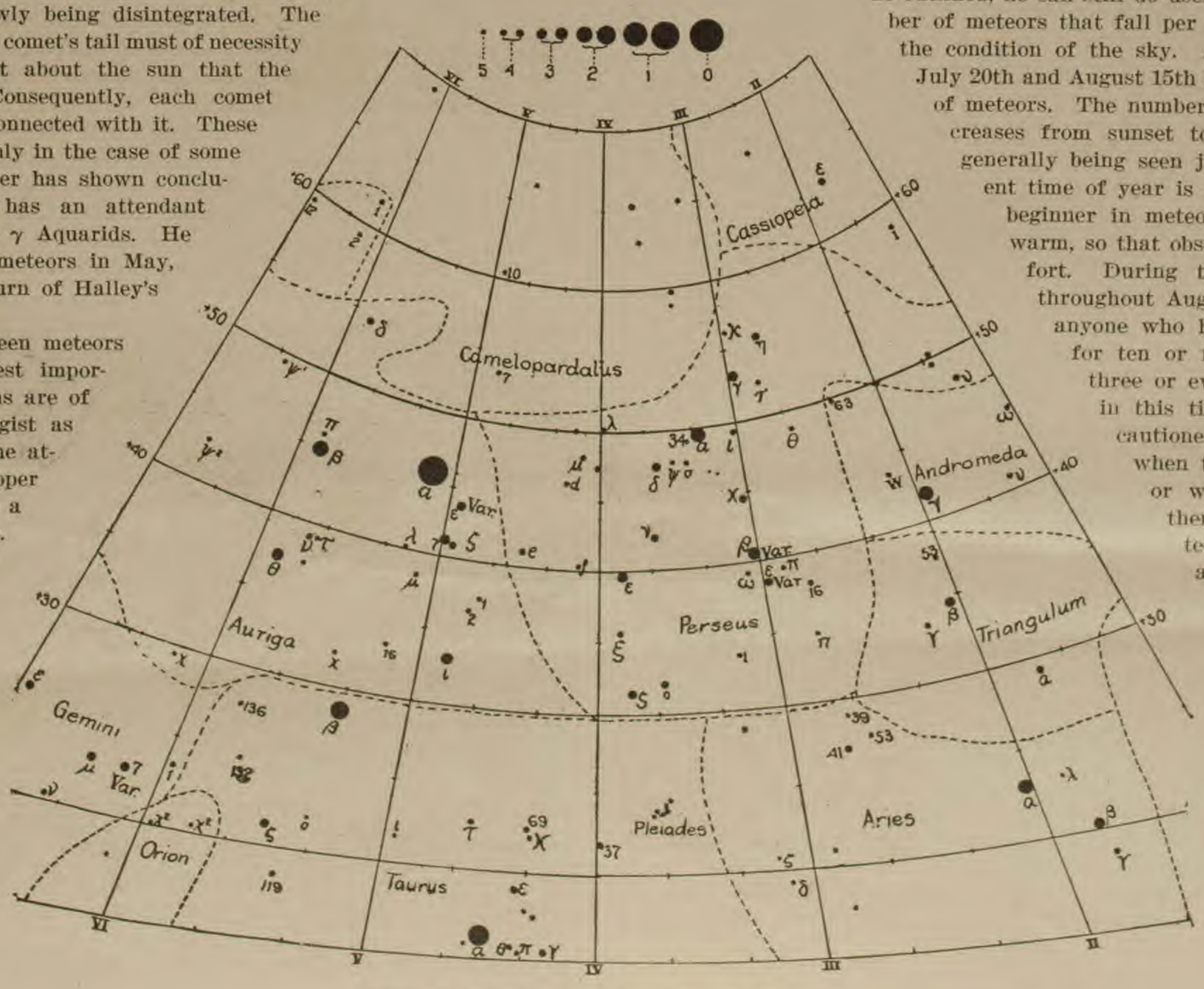
It was really not till fifty years ago, or after the wonderful shower of 1866, that the great importance of meteor observations was recognized. Schiaparelli showed that the August meteors and Tuttle's comet moved about the sun in the same path; while it was soon demonstrated that the November meteors and Temple's comet likewise had a similar connection. When in 1872 Biela's comet failed to reappear, but instead there was a shower of meteors radiating from the point where the comet would have been seen, then it was evident that the connection between comets and meteors was not an accidental one. Biela's comet was the first one to be seen to break up. A similar catastrophe has recently happened to Mellish's comet, as observed by Barnard at Yerkes Observatory on May 12th, 1915.

Our best theory regarding the tail of a comet is the light-pressure theory: that the particles forming the tail of the comet are repelled by the pressure of sunlight. As a result of this theory, the comet is continually forming a new tail, the comet is slowly being disintegrated. The particles that once formed the comet's tail must of necessity follow nearly the same orbit about the sun that the head of the comet took. Consequently, each comet must have a meteor shower connected with it. These showers have been detected only in the case of some of the periodic comets. Olivier has shown conclusively that Halley's comet has an attendant meteor shower known as the γ Aquarids. He has observed some of these meteors in May, 1915, five years after the return of Halley's comet!

While this connection between meteors and comets is of the greatest importance, still meteor observations are of great value to the meteorologist as they tell him the height of the atmosphere, the drift of the upper atmosphere, etc. Meteors in a shower move in parallel paths. These objects, which are comparatively near to the observer, are projected by the eye backward to the celestial sphere, with the result that by perspective the meteors all appear to radiate from a point—or rather small area—in the sky. Those meteors nearest the radiant have usually the shortest paths, those farthest away the longest. The meteor shown takes its name from the constellation in which the radiant is found. The accurate position of the radiant is specially desirable, and this may be found by anyone who exercises a little care and a little patience. The general plan for observing is to have a map before one, specially prepared for the part of the sky where the observer is watching, and put down on this map as accurately as possible the meteors as they are seen. If the meteor paths when produced backward are to intersect in the radiant, the positions of the individual meteors must be plotted with accuracy. This, however, with a little experience can easily be attained.

Prof. Charles P. Olivier of the Leander McCormick Observatory of the University of Virginia has observed more meteors than anyone else in America, and he is a recognized authority on their study. He has given the benefit of his experience in some printed rules, which if followed by a beginner, will make him a valued meteor observer. The National Academy of Sciences has awarded to the Leander McCormick Observatory a small grant for the purpose of encouraging meteor researches. Fortunately a series of valuable maps of the sky have just been published by Dr. Reynold K. Young of the Dominion Observatory. To all those who will engage in systematic observations of meteors and who will write to the Leander McCormick Observatory, University of Virginia, a series of maps and a set of rules for observation will be sent free of charge. The directions for observing meteors as given by Prof. Olivier are as follows: Maps are prepared of the region of the sky that is to be specially observed on a given night. On a separate *second* sheet, a number of columns are ruled, headed as follows: 1, time; 2, number; 3, class; 4, color; 5, magnitude, 6, length of path; 7, duration in tenths of seconds; 8, duration of train in tenths of seconds; 9, remarks; 10, serial number; 11, accuracy. The designations are mostly self-explanatory; 2, gives the number of the meteor for the night; 10, the serial number for the year (please omit); 11, gives whether accuracy was good, fair, or poor. On the map beside the plotted path of the meteor is placed the number of the meteor for the night. The methods used to obtain the most accurate plot of a meteor's path are as follows: The greatest care must be taken to obtain the *direction* and any *one* point over which the meteor passed. Frequently a meteor's beginning and ending fall at or near a very conspicuous star, or at such a distance between two stars that it is easy to estimate the distance very accurately. In such cases the direction, determined nearly always by holding up a straight rod so that it appears to lie parallel to the meteor's path in the sky, serves mainly as a convenient check. In most cases, however, the meteor neither begins nor ends at a point which is easy to determine. Then by glancing backward and forward along the rod, the eye can generally pick up some satisfactory star near to the meteor's path. As the eye readily estimates the length of path of a meteor with fair accuracy, the parts in front and behind the chosen point can be estimated instantly, and by means of another reference point entirely outside the path, the meteor's position can be obtained with great accuracy and speed.

In case an observer may feel unable to undertake the full programme of work as outlined, he can still do useful work by counting the number of meteors that fall per hour with careful notes as to the condition of the sky. Anyone who observes between July 20th and August 15th is sure to catch a large number of meteors. The number of meteors seen per hour increases from sunset to dawn, the greatest number generally being seen just before sunrise. The present time of year is a most auspicious one for the beginner in meteor observing. The weather is warm, so that observations can be made in comfort. During the latter half of July and throughout August a meteor may be seen by anyone who has patience enough to watch for ten or fifteen minutes, while two or three or even half a dozen may be seen in this time. The beginner should be cautioned against trying to observe when the sky is not perfectly clear, or when the moon is bright, for then only the very brightest meteors can possibly be seen. Most astronomical work is valuable only when followed up regularly and systematically, but each night's work on meteors is separate and valuable by itself. Each observer will get full credit for all of the work which he sends in to the Leander McCormick Observatory, which by the grant of the National Academy, has become the central bureau for meteor observations in America. Here is a splendid chance for amateurs to do real astronomical work.



Meteor observer's map for July and August.

Railroad Construction at Night in Africa

PICTURED in the accompanying engraving is an apparatus that is being used in Africa to permit of railroad construction at night. A freight car is utilized as a lighting plant. Projecting from a tower built at one end of the car is a light arm that extends far out over the track. At the extreme end of this arm two searchlights are placed, while other lamps are located at intervals along the arm. By means of this arrangement plenty of light can be shed upon the portion of the track that the arm overhangs, while beams of the searchlights can be cast ahead where the work of preparing the roadbed is under way. The lighting plant permits of carrying on work in the cool hours, while the torrid sun has retired below the horizon.

Lighting plant for railroad construction at night in Africa.

First Aid in the Hog Yard

ABOUT the only time a hog forgets his fleas is when he is eating. The rest of the time the porker grunts and rubs against the fence post or the corner of the pen. Once a week if the farmer will pour about a pint of kerosene along the back of each hog from the ears to the tail he will temporarily alleviate the trouble.

However, it takes quite a little time to coal-oil the hogs as each animal has to be penned or caught. That is why an ingenious farmer devised the oil roller, which is illustrated here. This roller consists of an iron cylinder which revolves over and through a pan of oil. When the hog rubs against the cylinder his body is coated with the oil, which is obnoxious to fleas. The more the hog rubs the more oil he brushes over his body. The oil tank and the roller are bolted to a wooden platform or to heavy two by sixes or four by fours set in the ground so that the hogs will be unable to overturn the device. It will only take the animals a little while to learn that the roller is a practical first aid with which to fight the flea. Every hog lot should be provided with one of these oil rollers or a home-made makeshift to serve the same purpose.

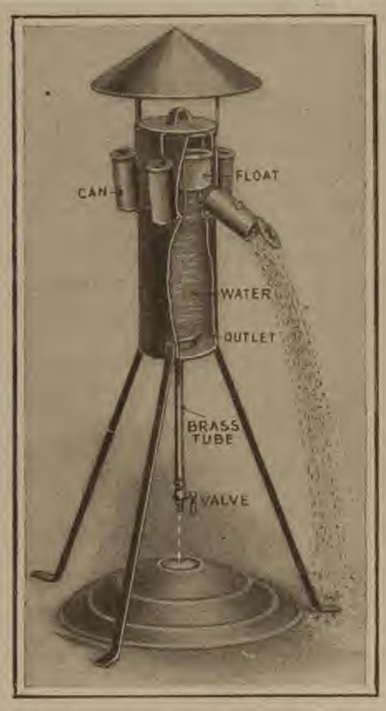
Using an oiler to rid himself of fleas.

An Automatic Poultry Feeder

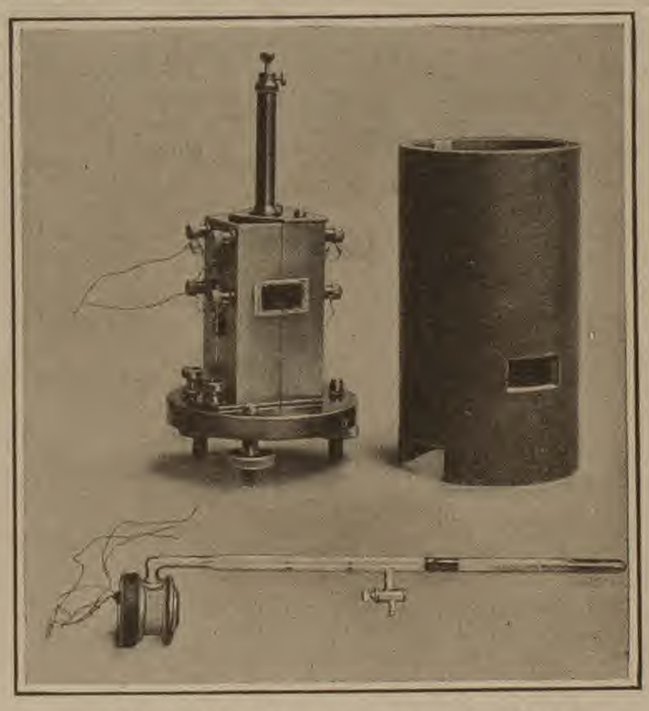
"TIME is Money" is a true saying, and the farmer's wife who keeps poultry knows full well that regular feeding is essential if they are to thrive and gain strength and put on weight every day, besides doing their duty in providing eggs for the household and markets. To poultry keepers all the world over it is important that where large numbers of fowls are kept their assistants should see to it that their feathered charges are supplied with sustenance in just sufficient quantities at precise intervals and that this supply of drinking water is ample and clean. This means a certain amount of detail work and supervision, which again means time or money's equivalent, spent on the care of the birds. To save the time of the poultry keeper and relieve him of much otherwise necessary work and supervision, are the objects of the apparatus here illustrated. It works on the principle of the water-clock. The water is supplied to the fowls in a drinking cup at ground level, but the food is out of sight and out of reach until served out by this automatic quartermaster at the proper time. At the base of the cylindrical water tank is a small threaded aperture with a collar projecting about ¼ inch above the base inside. This outlet is covered with fine gauze and its slight elevation above the floor of the tank prevents its being choked by sediment. A brass tube 18 inches in length is fitted into the hole and at the end of the tube is a valve which allows the water to drop to the pan placed on the ground beneath. A gallon of water is poured into the tank and in it is placed a float.

The can-shaped food containers are fitted with flap-lids and have each a strong wire handle or hook-shaped appendage which passes over the upper edge of the tank and down inside, terminating in a hook that passes through a flange on the float. The bottoms of the cans are hinged to the tank. The wire handles are of different length so that as the float descends they are successively pulled down at predetermined intervals, throwing the cans over. When a can is thrown over the lid swings open and the feed is thrown out on the ground.

Each food container has stamped upon its lid a number representing the hours to elapse before it is released, reckoning from the time the apparatus is filled with water. Obviously, regularity in time of feeding and the quantity of food supplied to the birds at any given interval of time can be insured by selecting food containers with the corresponding length of handles. They can be arranged to feed at intervals of one or two hours in comparatively small quantities by varying lengths of handle, or the whole of the food can be served out in one batch at a longer interval from the time of setting the apparatus.



Water-clock poultry feeder.



Apparatus for measuring star heat.

Grinding a defective rail-joint with a hand-controlled machine.

The Machine That Measures the Heat of Stars

PERHAPS the most delicate thermo-electric battery ever constructed is that used by W. W. Coblentze, a physicist of the United States Bureau of Standards, in the radiation pyrometer with which he has succeeded in measuring the heat that reaches the earth from 112 celestial bodies, including 105 stars. These measurements are the first extensive series of the kind ever made, and the work was done by Mr. Coblentze in the Lick Observatory at Mount Hamilton, Cal., last summer. As an example of the amount of heat that the earth receives from the stars, Mr. Coblentze estimated that if the rays of Polaris, or the North Star, were focused upon a gramme of water, it would require a million years for the temperature of the water to be raised one degree Centigrade. The sun's rays will accomplish the same work in about one minute.

The distinctive thing about the pyrometer devised by Mr. Coblentze is its extreme delicacy, which makes it sensitive to a change in temperature of a millionth of a degree. With the aid of a three-foot reflector, his instrument will register the presence of a candle fifty-three miles away.

The vital part of the instrument is a thermal battery made by joining two wires of different metals—either platinum and silver or bismuth and silver—and covering the junction with a heat-absorbing surface painted with lamp-black. The wire used is so fine that it can scarcely be seen without the aid of a reading glass, and the absorbing surface is about the size of a pinhead.

This battery is inclosed in a glass cell with a window of fluorite. A vacuum is maintained in the cell, and it is placed in a telescope so that the light of the star to be observed is focused upon the fluorite window.

The tiny battery, or thermo-couple, is connected with a tangent galvanometer, which is inclosed in an armor of soft Swedish iron to protect it from extraneous magnetic influence. Thus the amount of current generated in the thermo-couple by the heat of the star is measured by the galvanometer. Within the galvanometer, a mirror smaller than a pinhead is suspended upon a fine thread of spun quartz. Some distance in front of the window in the galvanometer a scale is set up with a strong light upon it. This scale is reflected in the little mirror, which is observed through a microscope. There is a tiny dot upon one side of the face of the mirror. The generation of current in the thermo-couple causes the quartz thread to twist, turning the mirror from side to side; and this deflection is measured upon the reflected image of the scale.

An Electric Rail Grinder

THE accompanying illustration shows a very simple electric rail grinder developed at London, England. The machine is so light that it can be instantly taken off the rail on the approach of a car and be put to work again in the space of about thirty seconds. Therefore, it may be operated without interfering in the least with the regular service during the day. The ordinary rail grinders have to be used at night after the car traffic is stopped as they are so heavy and unwieldy as to call for a clear track and uninterrupted operation, which means night work and extra pay for foreman and operators.

It is claimed that night grinding results in some very indifferent work, the fitful light being responsible for disastrous

(*Concluded on page 53.*)

RECENTLY PATENTED INVENTIONS

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

Pertaining to Apparel.

GARMENT SUPPORTER.—JESSIE H. BANCROFT, 164 Sterling Place, Brooklyn, N. Y. The invention relates to garment supporters, especially hose supporters for use by children and adults, and refers more particularly to a device which comprises two operatively associated members arranged to encompass the body, and each having means for attachment to a stocking or other garment to support the same.

HEEL.—S. E. P. MATACOTTA, 1347 E. 35th St., Brooklyn, N. Y., N. Y. This invention provides a heel formed with a rotary member and with a clamping structure which is adapted to clamp the rotary member in any desired position for presenting a perfectly constructed rear heel structure notwithstanding the wear on certain parts of the heel.

COMBINATION SUIT.—W. K. JONES, 1501 Holyoke Ave., Wichita, Kan. In this case the drop flap can be securely fastened in position at the sides of the trousers and the skirt of the jacket also secured so as to cover the hip pockets and form an effective closure for the side slits between the trousers and the drop flap, thus excluding dust and dirt from the undergarments and person of the wearer, as well as protecting the hip pockets.

Electrical Devices.

ELECTRIC MEASURING INSTRUMENT.—L. LOGAN, 140 Hudson Ave., Peekskill, N. Y. This invention relates to improvements in measuring devices for electric currents, and has for an object to provide a structure in which the principle of the rotation of the plane of polarized light is utilized for measuring various currents of different strength.

PRESSURE CONTROLLED ELECTRIC SWITCH FOR MOTOR OPERATED PUMPS.—S. S. STAHL, Connellsville, Pa. This invention relates to an automatic switch of that type associated with a pressure responsive device for a pump or other system, whereby the switch of the pump driving motor is automatically opened and closed when the pressure of the fluid of the pump system increases or decreases to predetermined points.

Of Interest to Farmers.

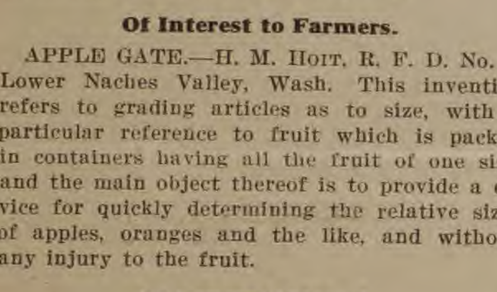
APPLE GATE.—H. M. HOIT, R. F. D. No. 6, Lower Naches Valley, Wash. This invention refers to grading articles as to size, with a particular reference to fruit which is packed in containers having all the fruit of one size, and the main object thereof is to provide a device for quickly determining the relative sizes of apples, oranges and the like, and without any injury to the fruit.

Of General Interest.

BULLET OR PROJECTILE FOR FIREARMS.—A. DOBREGEANSKY, Col. Guards-Infanterie, Petrograd, Russia. This invention increases accuracy of aim and the projectile's initial velocity without increasing the maximum permissible pressure of powder gases in the barrel of hand firearms. Besides this, the construction of the bullet permits it to maintain, to a great extent, the speed when flying, by which the utmost piercing capacity of the bullet is conditioned. All their ballistic qualities are attained because the center of gravity of the bullet is transferred nearer to its head portion and the core of the bullet is made out of two metals: one a heavy and soft, the other a light and hard metal.

COLLAPSIBLE CORE FOR CONCRETE CULVERTS.—A. E. CAMBLIN, Stella, Neb. This improvement refers to collapsible cores for concrete culverts and other devices for use in concrete structures, or which are adapted to freely support mold-boards, the inventor's object being to provide a structure which may be readily and quickly collapsed and withdrawn from the molded structure.

APPARATUS FOR BURNING STUMPS.—S. F. ZYSSET, Thomas, Ore. Considerable time and labor is required to destroy stumps by burning, owing to the stumps being green or unseasoned, and there is difficulty in causing them to undergo combustion, and especially

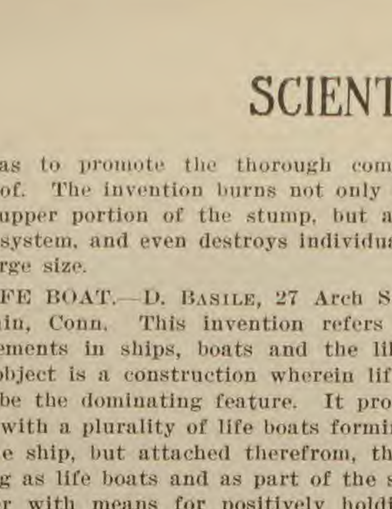


APPARATUS FOR BURNING STUMPS.

those portions of the stump which are close to the surface, or below the surface of the ground. It is desirable that combustion shall destroy the large mass of woody fiber just below the surface of the ground and commonly designated as the root system of the stump or tree. Yet considerable difficulty is experienced in supplying air to the root system in such manner as to promote the thorough combustion thereof. The invention burns not only the entire upper portion of the stump, but also the root system, and even destroys individual roots of large size.

LIFE BOAT.—D. BASILE, 27 Arch St., New Britain, Conn. This invention refers to improvements in ships, boats and the like, and the object is a construction wherein life boats will be the dominating feature. It provides a ship with a plurality of life boats forming part of the ship, but attached therefrom, the same acting as life boats and as part of the ship together with means for positively holding the boat in place until it becomes desirable to use the auxiliary boats.

PAPER BOX HANDLE.—C. J. FREESE, Elyria, Ohio. The invention has reference more particularly to a handle for paper boxes formed of two sections, which handle interlocks the two sections when they form a box. The invention provides a simple, strong and

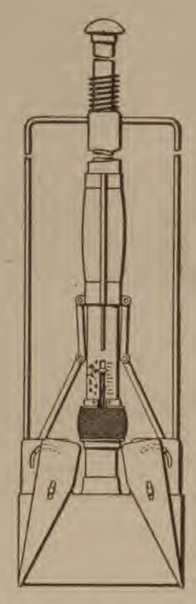


PAPER BOX HANDLE.

inexpensive handle for facilitating the carrying of paper boxes, which handle will not add greatly to the cost of manufacturing the box nor to the bulk thereof in storing the sections forming the box.

SHOE BUTTON SEPARATOR.—A. F. SEAMAN, 334 South Jackson St., Pottsville, Pa. By use of this device a number of buttons may be quickly and easily separated so that the different sizes may be withdrawn when desired. The buttons are quickly sorted and the different sizes of buttons stored separately in such manner that a particular size of button may be withdrawn when desired without disturbing the other size or enabling the same to again mix.

BUTTER CUTTER.—H. B. DROSIN and M. GORDON, care of the former, 1505 Metropolitan Ave., Brooklyn, N. Y., N. Y. This invention provides a butter cutter comprising an open bottom box having an adjustable plunger therein for determining the weight of the cake of butter to be produced, there being a novel



BUTTER CUTTER.

arrangement of cutting devices which move inwardly from the ends of the box along the bottom thereof for severing the butter from the mass after the box has been filled, by the pressing of the device downwardly into the mass of butter.

HAIR DRYING FRAME.—T. C. RANDALL, Box 194, Tenafly, N. J. This invention relates to an appliance adapted to be used in drying ladies' hair after the same has been washed, or after bathing, whereby the hair is supported off the shoulders to enable the air to obtain better access thereto and to enable an attendant to more easily rub the hair dry and comb it.

SAFETY AND SANITARY ENVELOPE.—H. H. PALMER, 64 Columbus St., Charleston, S. C. The object here is to provide a fastening means for the closing flap composed of coacting elements which may be engaged with facility and which will involve the minimum cost of manufacture. The prime object is to provide a mailing envelope, the contents of which will be protected without the necessity of sealing or gumming the closing flap of the envelope.

PROJECTING INSTRUMENT.—F. W. LANE, Chico, Cal. The invention provides an instrument more especially designed for drafting from any good pattern the true contour of the cutting edge of a knife or cutter, such as is used in the revolving cutter head of a planer, matcher, shaper, sticker or other similar woodworking machine.

POWDER BLOWER.—A. SINGER, 68 Rivington St., New York, N. Y. This improvement has reference to powder blowers and more particularly to an attachment adapted to be applied to a cam or container of powder whereby the powder can be forced out from the can or container by puffs.

VETERINARY INSTRUMENT.—C. J. KORINEK, Address Korinek Veterinary Remedy Co., Medford, Ore. This invention is an improvement in balling irons or capsule guns employed in administering medicine, in solid form or capsules, to horses or horned cattle, by the mouth, the same being made so that the medicine can be placed in the posterior part of the animal's mouth, so that it will be swallowed without mastication. Such instruments have generally been made entirely of iron and difficult to use.

COLLAPSIBLE FOLDING TABLE WITH ADJUSTABLE DRAWING-BOARD AND ARTIST'S EASEL.—L. S. COZZENS, care of H. E. Brown, 31 Nassau St., New York, N. Y. This invention provides a table and a device by which the drawing-board attached to the table may be inclined at any angle from horizontal to vertical position; provides a device by which the drawing-board may be revolved and automatically locked in normal positions; provides

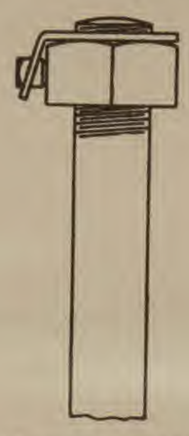
COLLAPSIBLE FOLDING TABLE, DRAWING BOARD AND EASEL.

for the removal of the drawing-board, or the substitution of the board by a drawing-board of similar or other dimensions; provides an arrangement whereby the drawing-table may be used as an artist's or draftsman's easel, or any other purpose for which such a device can be employed; and provides a shell which can be folded up compactly with the table.

Hardware and Tools.

SELF LOCKING HINGE.—C. DIENER, 1421 Myrtle Ave., Brooklyn, N. Y., N. Y. Means are provided to hold the leaves of the hinge in different relative positions immovable with respect to each other, the sleeve or knuckles of the hinge plates or leaves being designed to co-operate with each other or with spring actuated means in order to hold the leaves of the hinge in certain relative positions or closed as desired.

NUT LOCKING APPLIANCE.—G. W. WATTS, 328 Central Ave., Hot Springs, Ark. This invention is an improvement in nut locks in which a clamp-screw is threaded through the side of a nut and its point engages the thread



NUT LOCKING APPLIANCE.

of the bolt to which the nut is applied. The nut is first of all locked by the clamp-screw, and the latter is in turn locked by a forked device plate, so that loosening of the nut by jarring or vibration is impossible.

SINGLE ACTING LAVATORY HINGE.—O. KATZENBERGER, 215 W. Huron St., Chicago, Ill. This invention relates to improvements in spring hinges, and particularly to what are commonly known as lavatory hinges, and has for an object to provide a structure which may be quickly and easily adjusted so as to hold the door closed or to hold the door open.

SYRINGE.—F. S. DICKINSON, care of Becton, Dickinson & Co., Rutherford, N. J. In this device the plunger is held against accidental dropping out of the barrel when pointing the nozzle upward. To accomplish this result, use is made of a clip adapted to engage the barrel and spring arm extending from the clip and ranging lengthwise of the syringe, the arm extending beyond the rear end of the clip and being bent inward so that its free end bears against the outside of the plunger of the syringe to hold the said plunger against accidental movement in the barrel.

THUMB TACK.—P. A. FISCHER, 137 W. 141st St., New York, N. Y. This tack is for use by draftsmen and other persons and is arranged to permit the user to readily push the tack in place, and to allow of quickly removing it without resorting to a prying operation and without danger of marring the drawing or other article held in place by the tack.

TOOL.—J. J. PATTERSON, 702 4th St., Coeur d' Alene, Idaho. This invention provides a tool having means to secure it to a bench or like support, and possessing marked practicability as a clamp for cabinet makers and wood working, or as a vise convertible for use either as a pipe vise, or for filing and other vise work, and adapted to constitute an efficient tool convertible into either a pipe wrench or monkey wrench.

TOOL.—E. C. WORNS, 287 W. 127th St., New York, N. Y. This invention provides a tool adapted to be employed as a scraper, or an ironing tool by furriers, for scraping the fat from the furs, and for ironing down a seam, in order to perform operations now requiring a scraper and a separate ironing device.

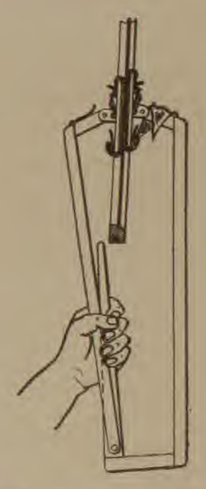
Heating and Lighting.

GAS COCK.—G. W. CAMPBELL, JR., 203 N. Vodges St., Philadelphia, Pa. This invention relates to gas cocks used in connection with flexible conduits, as for lamps, stoves and the like, and one of the main objects thereof is to provide means in connection with such devices whereby the gas will be automatically shut off in the event of disconnection, accidentally or otherwise, of the conduit from the cock.

METHOD OF WORKING AMMONIA RECOVERY PRODUCER-GAS PLANTS.—T. RIGBY, Station Hotel, Dumfries, Scotland. This invention greatly reduces the cost of production of briquet fuel made from brown coal peat lignite or the like. It utilizes all or a portion of vapor in an ammonia recovery gas plant worked in conjunction with a fuel briqueting plant by mixing the vapor with air compressing the mixture, and passing it under pressure into the air supply of the gas producers to replace wholly or partially the auxiliary steam usually employed for this purpose.

Household Utilities.

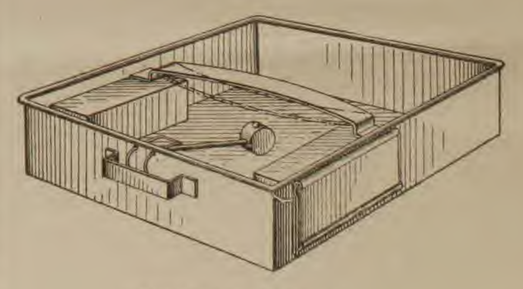
WINDOW CLEANER.—F. S. NEYDHART, 262 Palisade Ave., West Hoboken, N. J. This invention comprises a two-part frame, the parts being pivoted together at a single point, one of the parts including a rigid handle co-operat-



WINDOW CLEANER.

ing with the adjacent pivoted part so as to vary the pressure upon the pane, and each of said pivoted parts having connected to it a block to which are detachably connected a plurality of cloths with means for readily detaching a soiled cloth or removing it out of the way so as to present a fresh cloth to the work.

DRIP PAN ALARM.—M. JACOBSON, 115 E. 82nd St., New York, N. Y. This invention relates to a refrigerator or ice box appliances, and has particular reference to drip pans for such devices. Among the objects of the invention is to provide an audible alarm for a drip pan, which will serve to announce to the occupants of the house the fact that the drip pan



DRIP PAN ALARM.

is full or nearly full of water; whereby the likelihood of flooding the floor of a building will be practically eliminated. Means provide for breaking the circuit of alarm mechanism simultaneously with the grasping of the pan handle while withdrawing it from the refrigerator.

UTENSIL KNOB.—E. C. FRISK and E. C. ANDERSON, Somerset, Wis. This invention has

reference to knobs for use with cooking utensils and the like, and has reference more particularly to a device fashioned from an elongated, spirally disposed member and means for attaching said member directly to the utensil or body.

Machines and Mechanical Devices.

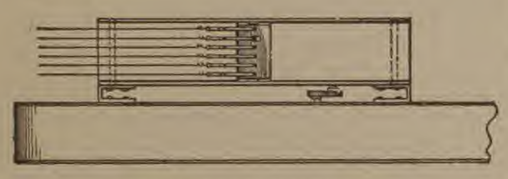
TOOTHPICK HOLDER.—C. DICKSON, 243 Franklin St., Elizabeth, N. J. The invention relates to receptacles for articles, such as toothpicks, matches and the like, having means for individual delivery of the articles contained therein, and one of the main objects is to insure a single delivery of one of said articles in a single actuation of said delivery means.

NUT TAPPING MACHINE.—T. M. DANIELS and J. C. HOLSCHEMACHER. Address the former, 327 South La Salle St., Chicago, Ill. This invention relates to machines for producing the screw-threads in nuts already provided with the boxes, and the main object is to provide such a machine which accomplishes this result automatically and continuously. The machine is very speedy in operation and, therefore, of great capacity.

PUMP ROD CONNECTOR.—M. HARTNER, Herndon, Kan. Mr. Hartner's invention relates to pumps and especially of that type employed in connection with wind-mills, and the main object thereof is to provide a connection between the wind-mill and pump which may be quickly and easily made operative or inoperative.

ACTUATING DEVICE FOR PERCUSSION TABLES.—A. C. CAMPBELL, Asheville, N. C. The invention provides a new and improved actuating or impelling device for percussion tables, arranged to give the desired impetus to the percussion table and inertial resistance to impact with a view to facilitate the separation of the heavier and lighter materials.

CLOCK ATTACHMENT.—J. R. MOORE, Winona, Tex. The object here is to provide an attachment especially adapted for use with alarm clocks for operating a series of alarms



CLOCK ATTACHMENT.

or signals arranged in different rooms of a building or in other separated stations for simultaneously sounding the alarms or for operating the signals at predetermined times.

VENDING MACHINE.—J. CARTUN, 401 South St., Philadelphia, Pa. This machine has provision for vending different publications, the construction and arrangement being such that the dropping of a coin in an indicated chute closes an electric circuit whereby mechanical means then provides for withdrawing the desired publication and depositing it outside of the machine to be taken away by the purchaser.

MACHINE FOR GUMMING AND APPLYING LABELS TO BOTTLES, CANS, AND SIMILAR OBJECTS.—C. L. HATCHETT and E. G. RHODES, 131 Wool Exchange, Coleman St., London, E.C., England. The cans or bottles are arranged in a row on an inclining table down which they slide and are delivered to a pair of rollers where the wrapping of the label is effected. An ingenious mechanism is provided for delivering the bottles one at a time to the rollers and for discharging the bottle from the machine after the label has been applied.

BANDING MACHINE.—M. F. ANDERSON, care of Standard Oil Clothing Co., 320 Broadway, New York, N. Y. This invention provides a machine more especially designed for wrapping one or a series of gummed bands around a roll of oil cloth or other fabric and arranged to feed the bands to the rolls, to cut off the bands to proper length, to moisten the ends of the bands so that when the bands pass onto the peripheral face of the roll to be banded then the forward end sticks to the roll and the rear end overlaps the forward end and is fastened thereto.

AUTOMATIC FOCUSING DEVICE.—L. W. BUTLER, 324 Putnam Ave., Brooklyn, N. Y., N. Y. This device is adapted for use on almost any kind of projecting apparatus for the sake of making enlarged images of given objects. It is especially designed for making enlargements of negatives and it comprises essentially a holder for an object which is to be enlarged, a focusing device, and a screen on which the object to be enlarged is focused in the well-known way.

LOOM ATTACHMENT.—P. REILLY, care of J. P. SCHMIDT, 15 Greene St., New York, N. Y. In the present patent the object of the invention is the provision of a new and improved loom attachment arranged to insure the formation of a perfect selvage by preventing nicking thereof and to allow forming of fringes by the welt.

RECORDING APPARATUS.—M. IRION and A. E. MUELLER, 404 W. Market St., Louisville, Ky. This apparatus is for use in connection with automobiles, locomotives and other vehicles for the purpose of indicating the speed of travel at any moment, the daily and total mileage and the time of day, and for making a record of the rate of travel and the times and durations of stoppage.

GRAB FOR TRANSPORTERS, EXCAVATORS, AND THE LIKE.—FRIEDRICH SOCHOR, Vienna, Austria-Hungary. The drawbacks of previously constructed grabs with variable gearing suitable for the handling of material in large pieces, reside in their great height necessary to obtain a sufficiently large opening, and their great weight owing to the considerable power required to close the jaws of the grab, and the consequence is that the crane is compelled to transport a considerable total weight. The present invention overcomes the above drawbacks by the construction of grabs of small height.

SPEED INDICATING AND MILEAGE REGISTERING APPARATUS.—M. IRION and A. E. MUELLER, 404 W. Market St., Louisville, Ky. This invention relates to an apparatus for use in connection with automobiles, locomotives and other vehicles. An object is to provide an accurate speed indicating means or speedometer of that type, including centrifugally acting elements, such as weights, whose outward movement is opposed by a series of finely adjusted springs.

SOUND BOX.—J. HOFFAY, 500 5th Ave., New York, N. Y. This invention has reference to improvements in sound boxes or the like for gramophones, phonographs and the like machines having the stylus lever made of a forked formation, the bifurcations straddling the diaphragm, which formation is not *per se* new.

GRINDING MACHINE.—C. E. WALLING, 5 Avondale Apt's., Indianapolis, Ind. This machine is more especially designed for grinding taps, reamers and similar tools, and arranged to provide the cutting teeth of a tool with peripheral faces sloping rearwardly and inwardly from the front edges of the teeth to the back thereof.

AUTOMATIC STUFF BOX FOR PAPER MAKING MACHINES.—W. P. FEENEY, 32 Elm St., Hudson Falls, N. Y. This invention has for its object the provision of a stuff box for paper making machines having means to direct back to the chest all surplus stock before the surplus has sufficiently accumulated to increase the pressure at the outlet leading to the mixing box.

CIGARETTE BOX GROUPING MACHINE.—JOSÉ IBARRA, Habana, Cuba. This invention provides means for arranging in order cigarette boxes so that they may be formed into what is termed a "wheel"; and provides means for grouping the boxes and coincidentally fixing the ends of the sealing stamps with which said boxes are provided.

Railways and Their Accessories.

PORTABLE SNOW SCRAPER FOR TROLLEY CARS.—N. DAROIS, 2165 Nostrand Ave., Brooklyn, N. Y., N. Y. This scraper is especially designed for clearing street car tracks, and is adapted to be applied to the front of the car to take the place of the fender and thereby scrape the snow off the tracks and discharge it to the right side, which is especially advantageous in a double track system.

AIR COCK OPERATOR.—J. B. DOYLE, Hamburg, Miss. The invention relates particularly to freight cars, and specifically to air cocks, at the ends of such cars, which are adapted to be opened when two cars are coupled together and closed when said cars are uncoupled, and the main object is to provide means for accomplishing these operations from a position of safety, on the sides of the cars.

TORPEDO HOLDER.—W. J. STROHM, Moline, Kan. The invention refers to signals, with especial reference to the flags and torpedoes commonly used on railways, and the main object thereof is to provide a flag-stick which also serves as a container for a suitable supply of torpedoes, whereby the certainty of such a supply, on demand, is assured, and whereby no loss of torpedoes may occur.

FREIGHT CAR CARD HOLDER.—T. A. BIGGS, 316 Quincy St., Rapid City, S. D. This device is comparatively simple and inexpensive and so designed as to hold cards in such a manner as to be easily and conveniently applied or removed, and thereby dispense with the necessity of using the hammer and tack method now commonly employed in placing cards on freight cars.

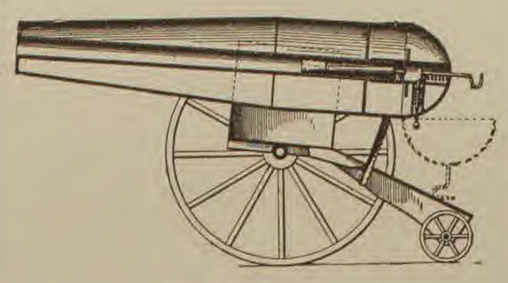
VALVE MECHANISM.—J. G. BUCHANAN. Address Hiram A. Hatfield, Box 101, Forest Grove, Ore. The inventor provides a device which is to be used in connection with an automobile triple valve for setting brakes either by applying excess air pressure which is carried on the engine, to the train line air pressure, or by the use of automatic air pressure as is now used, or by both excess air pressure and automatic air pressure combined.

DRAW BAR AND COUPLING CONNECTOR.—W. H. MAHONEY, 9 North St., Hingham, Mass. The invention provides means for quickly and readily removing couplers from the yoke members of railway vehicles; effects a saving in the cost of maintenance of yoke members and couplers therefor; and provides a connector for couplers arranged to fit the parts on which it is mounted singly and to eliminate noise and wear thereof.

Pertaining to Recreation.

SMOKING DOLL.—S. W. STERN, 415 Chauncey St., Brooklyn, N. Y., N. Y. The doll has a tube extending from a cigarette in the doll's mouth to a bulb within the doll, and another tube extending from the bulb with branches leading to the doll's mouth and nose so that the bulb may be pressed and smoke may be drawn through the first tube through a valve at the bulb and the smoke may be exhausted from the bulb to the second tube through a second valve, the smoke being led by the second tube and tube and branches through the doll's mouth and nose.

TOY CANNON.—Z. E. HOUSE, Cass Lake, Minn. This invention has for its object the provision of a device of the character specified, so constructed and arranged that it will



TOY CANNON.

explode a paper fulminate cap, and will utilize the products of the explosion to project a ball of cotton, paper or like light materials. The accompanying engraving represents a longitudinal vertical section of the improved cannon.

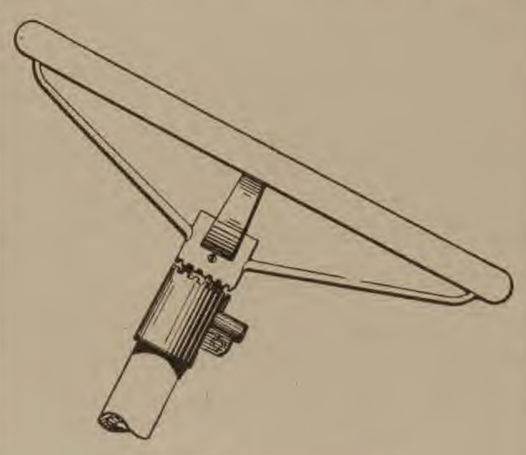
AMUSEMENT APPARATUS.—G. MULLER, 40 Beverly Road, Ridgewood, N. J. In this case the object is to provide a new and improved amusement apparatus more especially designed for use in pleasure resorts, parks, fairs and like places, and arranged to carry passengers through the air in imitation of a trip in an aeroplane.

Pertaining to Vehicles.

DEVICE TO PREVENT THEFT OR UNAUTHORIZED USE OF AUTOMOBILES, MOTOR BOATS, AND THE LIKE.—H. F. FAGAN, 143 W. 95th St., New York, N. Y. In this case the invention comprises a device for locking the steering wheel of the automobile or boat to the body of the vehicle in such a manner as to hold the steering wheel against rotation, and thereby prevent the steering of the vehicle in a desired course.

TIRE LINING.—L. P. DESLAURIERS, P. O. Box 42, Ware, Mass. This invention relates to tire linings, especially those linings which are placed between the inner tube and outer casing of a pneumatic tire. An object is to provide a knitted fabric for covering inner tubes, said fabric being continuous in form and being so shaped as to obviate the formation of wrinkles or creases.

STEERING WHEEL LOCK.—N. SMITH, 131 North Walnut St., East Orange, N. J. An object of the invention is to prevent an unauthorized person from unlawfully appropriating the vehicle by driving the same away. A further



STEERING WHEEL LOCK.

object is to provide a lock which forms part of the steering column and whereby the steering wheel may be locked in any desired position. The lock for the steering wheel normally leaves freedom of movement to said wheel.

STEERING MECHANISM FOR VEHICLES.—J. H. AYRE, Box 435, Tilton, N. H. This invention has for its object the provision of a steering mechanism for vehicles having a threaded rod which is operated by a steering wheel and which meshes in a nut articulated to levers connected with the usual automobile axles, pivoted on vertical axes.

ANTISKIDDING DEVICE.—D. V. KAUFMAN, 227 E. 119th St., New York, N. Y. This invention relates to an attachment for the wheels of automobiles and other vehicles employing similar wheels, and an object is to provide a device which may be readily applied to the wheel. It provides a device presenting a substantially complete covering for the tread of a tire, or in separated sections.

AUTOMOBILE THEFT INDICATOR.—J. A. STEINMETZ, 736 W. View St., Germantown, Philadelphia, Pa. The object here is not to render the automobile supposedly inoperative, but to provide means which will have a deterrent effect upon persons who would otherwise steal the car. Therefore the invention obscures, blinds or obliterates the serial number of a license tag or a part thereof, so that any person operating a car with the license so concealed would render himself liable to arrest.

HANDLE BAR.—E. J. CORTINES, care of Cortines Supply Co., 1411 Commerce St., Dallas, Tex. The invention relates more particularly to bars for bicycles adjustable on the screw stem, so as to dispose the handles in different positions. These bars have been made rigid with each other, and also have been made adjustable relatively to each other, adjustable connection being usually effected in the type of handle to which the invention relates, between the handle bar forging and a lateral arm on the stem.

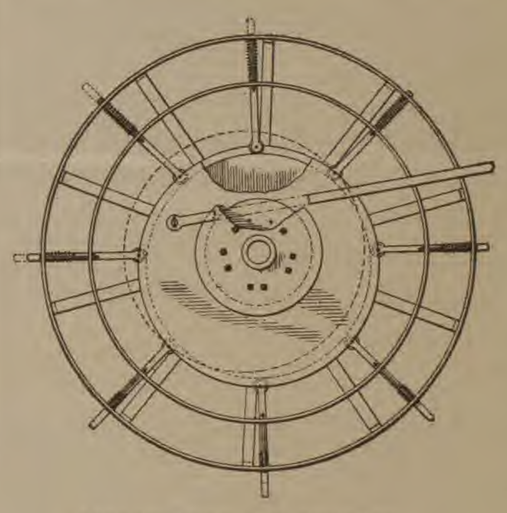
WASHING DEVICE FOR AUTOMOBILES AND OTHER VEHICLES.—H. T. FORD, care of C. F. Ford, Central Valley, N. Y. This invention relates to a sponge holder which is especially adapted to be used in connection with the nozzle of a hose, whereby the sponge can be held directly in front of the nozzle so that the sponge will be kept constantly supplied with water during the washing operation, as in cleaning vehicle wheels, bodies and the like.

SPRING CUSHION TIRE.—J. W. T. STEPHENS, 220 Whitney Bank Bld'g., New Orleans, La. This invention has for its object the provision of a device of the character specified, having the resiliency of a pneumatic tire, but which may be manufactured at a much lower cost, and wherein the danger from puncture and blow-outs is eliminated.

TONGUE SUPPORTER.—H. A. JOHNSON and V. J. PEARSON. Address M. H. Scott, Attorney, Piper City, Ill. The device is adapted for supporting wagon tongues in horizontal position during use, to relieve the necks of draft animals from the weight of the tongue, and wherein the mechanism is so arranged that the tongue may be quickly released from the supporter or connected therewith to permit the free end of the tongue to rest upon the ground when the wagon is not in use, thus relieving the support of the weight of the tongue when the wagon is idle.

RESILIENT WHEEL.—B. J. DRYER, care of C. D. Halsey, 15 Broad St., New York, N. Y. This invention relates to resilient wheels of the type having non-deformable treads and the resiliency is obtained by means of pneumatic balls positioned between the inner section of the wheel and the outer tread section so as to absorb the shocks and take up the thrust imparted to the tread section.

ATTACHMENT FOR ENGINES.—F. R. NYBERG, 104 North 8th St., Lamar, Colo. This invention is an improvement in wheels for traction engines and the like, and has for an object to provide a mechanism in connection



ATTACHMENT FOR ENGINES.

with the usual drive wheel, for permitting the mud cleats usually used on the periphery of the wheel to be dispensed with, and wherein the said mechanism is so arranged that it may be brought into and out of operative position whenever desired.

Designs.

DESIGN FOR CLOSED DRAWERS.—ANNA HEUSER, care of W. Dumont, First National Bank Bld'g., Paterson, N. J. In this ornamental design for closed drawers, two views are shown, one a front elevation and the other a perspective representation of a pair of closed drawers.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

Railroad Building Under and Over the Streets of New York

(*Continued from page 47.*)

the subway work extends far below the grillage it is necessary to provide some form of support for the building during the period of construction. It was especially necessary to prevent this building from being disturbed in the least, because on the top floor are located a series of very delicate relays which would be thrown out of operation by the slightest shifting of the building foundation. The method employed is shown in Fig. 1, and is the invention of Mr. John F. O'Rourke. A pair of heavy steel girders, 7 feet deep and 35 feet long, were placed each side of each column and supported on timber crib work. These girders carried two pairs of transverse I-beams, placed close against the base of the column, one pair inside and the other outside of the building. The concrete at the foot of the column was then chipped away to expose the grillage beams. Steel straps were passed around the exposed end of these grillage beams and fastened to suspension rods hung from the transverse beams above. By means of heavy nuts engaging square cut threads on the suspension rods, the straps were drawn up until the weight of the column was taken off the ground and carried on the girders. To prevent the straps from being cut by the edges of the grillage beams, half-round blocks were inserted under the beams, and because the grillage beams were very closely spaced, it was necessary to stagger the suspension rods, as shown. By this means the telephone building is being supported on hanging foundations.

Work in a Buried Stream.

In the soft ground work undoubtedly the excavations through Canal Street and the crossing of the Hudson and Manhattan tubes at Christopher Street and the extension of Seventh Avenue, stand out as of chief interest. Canal Street gets its name from the canal or stream that flowed out of the "Collect Pond" at Center and White Streets, emptying into the North River. It was anticipated that a great deal of trouble would be encountered here. Broadway at Canal Street lies but ten feet above mean high water, while the excavation at this point had to be carried down 47 feet below the street surface in order to provide for passing the Canal Street tracks under the Broadway tracks. Water was encountered here almost immediately, but proved to be only surface drainings retained by a layer of peat and clay which proved to be the bed of the old stream. After the peat and clay bed had been cut through, the water disappeared until the excavation had been carried down about 18 feet from the surface. From that point on the water proved increasingly troublesome as the excavation was carried farther down. Sumps were sunk at different points in the excavation and pumps installed to drain out the water. The greatest care had to be exercised to keep the water from carrying sand with it, and thus undermining the surrounding buildings. Of course the excavation was lined with sheet piling, as were sumps, and the intake ends of the pumps were surrounded with perforated cylinders to serve as strainers. At one time twenty million gallons of water was being pumped out per day, enough to supply a city of 150,000 inhabitants with all the water it requires. Fortunately, the fine sand or quicksand which was most dreaded was encountered in seams or pockets, while most of the excavation was in a coarse gravel. Of course the water stood at higher elevation outside of the sheet piling than inside. This produced a considerable head of water, which at times would carry the sand under the sheeting. When the sand began to "boil" it had to be held down by bags of sand. Despite these trying conditions, the excavation has been completed and the entire subway structure at this point is rapidly nearing completion. However, because of the head of water at this point, it is necessary to introduce large masses of concrete in the subway structure to act as ballast

INQUIRY COLUMN

READ THIS COLUMN CAREFULLY. You will find inquiries for certain classes of articles numbered in consecutive order. If you manufacture these goods write us at once and we will send you the name and address of the party desiring the information. There is no charge for this service. *In every case it is necessary to give the number of the inquiry.* Where manufacturers do not respond promptly the inquiry *may* be repeated.

MUNN & CO., INC.

Inquiry No. 9434. Wanted the name and address of a manufacturer of special pins, 1/16 of an inch in diameter and ¾ of an inch long, the pins to be made of bone.

Inquiry No. 9435. Wanted the name and address of a manufacturer who can furnish grinding machines for the hollow grinding and finishing of razors. Up-to-date machines wanted.

Inquiry No. 9436. Wanted the name and address of a manufacturer of rat traps having a receptacle attached into which the rat drops and drowns.

Inquiry No. 9437. Wanted the name and address of a concern that can make an oil or grease gun. West preferred. Must be able to make in quantities of 10,000.

Inquiry No. 9438. Wanted the name and address of a manufacturer of light aluminium sheets, small tubing, rods and wire, also aluminium solder.

Inquiry No. 9439. Wanted the name and address of a manufacturer of a knitting machine which was on the market some years ago. The name of the machine was the Bickford Machine. It was a hand knitting machine, weighing about 15 pounds.

Inquiry No. 9440. Wanted the name and address of a concern selling Dr. Young's E-Z Sanitary Belt.

Inquiry No. 9442. Wanted the name and address of a manufacturer of a machine for cutting skeins of cotton and wrapping each bundle around the middle with wire. A machine of some such kind is used in the brush trade for wiring and cutting to length the bundles of bristles for paint brushes.

Inquiry No. 9443. Wanted the name and address of manufacturers of fuel oil burners and fire wall equipment, suitable for a maximum quantity of water evaporation in a locomotive firebox of the following dimensions: 2½' between door and flue sheet, 3' between grate level and crown sheet, 3' between side walls.

Inquiry No. 9444. Wanted the name and address of a manufacturer or patentee of a glass preserving jar made for use with air pumps for creating a vacuum.

Inquiry No. 9445. Wanted the name and address of a manufacturer who can make a combination pencil holder and point protector.

Inquiry No. 9446. Wanted the name and address of a manufacturer who can supply machinery for automatically wrapping cigars in thin imported tissue paper having the ends tightly wound and curled. Would consider purchase of machines or patent rights.

Inquiry No. 9447. Wanted to buy patented article, which is needed in every home, with a possible view to manufacturing and distributing.

Inquiry No. 9448. Wanted to get in touch with manufacturers who can make small gasoline motors and parts thereof. Must be able to handle considerable orders with expedition.

Inquiry No. 9449. Wanted the name and address of a manufacturer who is prepared to build a new and very simple stationary engine with or without gas producer.

Inquiry No. 9450. Wanted the name and address of a manufacturer who can build a light simple motor for light automobiles and for portable farm work.

Inquiry No. 9451. Wanted the name and address of a manufacturer of machinery for making egg albumen.

and hold the structure from floating up through the street surface.

The section eastward on Canal Street is now being excavated, and the point of particular interest is where it crosses under the existing subway at Lafayette Street, and the Centre Street loop. In the latter case it had been anticipated that a subway would be built on Canal Street and an underground bridge had previously been built at this crossing, so that the excavation could be carried on under the Centre Street loop without any difficulty. But at Lafayette Street no such provision had been made and the method of procedure was rendered very difficult for fear of disturbing the traffic in the existing subway above.

Along Canal Street a new method of building a retaining wall has been in use. Instead of using sheet piling at each side of the excavation and then building the concrete wall inside of this protection, the wall was started from the surface and built down. This method is the invention of Mr. J. B. Goldsborough and is shown in Figs. 3 and 4. The work is carried down in a set of pits which are alternately pushed forward and in such a way that each piece interlocks with the work to follow.

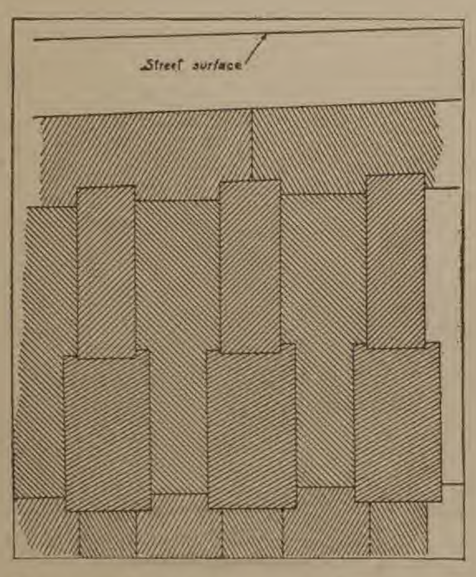


Fig. 3.—Building a retaining wall from the surface down.

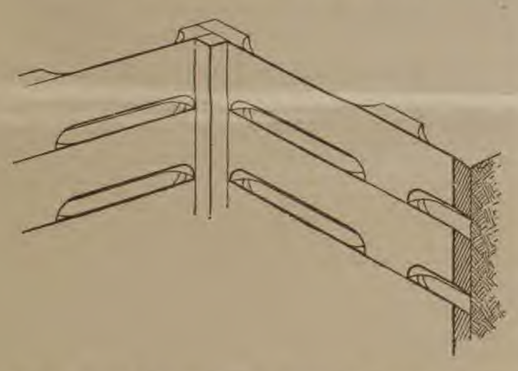


Fig. 4.—Chamfered boards with which the pits are lined.

The pits are lined with boards that are chamfered at the upper and lower edges, as shown in Fig. 4, so that earth can be filled in through the slots formed by the chamfered edges and packed in behind the boards. This system has been used successfully to carry down building foundations to rock without disturbing the cellars or basements of the buildings.

The drawing on pages 46 and 47 gives some idea of the appearance of the work on Canal Street when completed. It shows that the station for local tracks will be located on Broadway, while the express tracks will be depressed and will turn eastward under the northbound local track to a station on Canal Street; thence they will continue across town and over the Manhattan Bridge to Brooklyn. The Canal Street station will have direct connection with the Centre Street station, while there will also be stairways leading up to the Lafayette Street subway. There will be a practically continuous underground sidewalk from Broadway to Centre Street on each side of the subway.

Crossing the McAdoo Tubes.

The other interesting soft ground work to which we have referred is to be found at Christopher Street and the extension of Seventh Avenue. The tubes of the Hudson and Manhattan Railroad, popularly known as the McAdoo tubes, run rather close to the surface here and there is barely room for the new subway to pass between them and the street. The tubes are virtually floating in very soft material, and it would be unsafe to rest the subway directly upon them. Instead of that the structure will be supported on girders, spanning the tubes and resting on grillage beams embedded in concrete as shown in Fig. 2. The concrete forms a saddle over the tubes, and owing to the treacherous nature of the soil, it is being laid in narrow trenches, a slice at a time, to prevent disturbing the tubes.

(To be continued.)

An Electric Rail Grinder

(Concluded from page 49.)

"cuts" in the rail so that more harm may be done to rails than if they were left alone. When one considers that much of the grinding must not exceed 1/100th part of an inch, it must be admitted that such a delicate operation should be done only under good light conditions.

This electric rail grinder utilizes the human sense of touch in graduating the grinding force of the emery wheel. The depth of the "cut" is regulated by the pressure of the operator's hands on the shafts, and he is made unconsciously aware of the depth of the "cut" by the vibrations conducted along the arms of the machine. The successful "cut" should die out imperceptibly about fifteen to eighteen inches away from the joint, on either side.

The machine has a simple framework of ash providing a seating at one end for the motor. As the motor is close to its work, a low horse-power is sufficient to drive the grinding wheel. The motor is supplied with current from the overhead wire. A starter box is placed between the two arms, and a switch is located near the right handle.

There is an automatic "cut-out" used in connection with the starter so arranged that should the operator attempt to take a deeper "cut" than is advisable, the current is automatically cut off and the machine stopped. The machine will grind out corrugations equally as well as defective joints, and will smooth ten to fifteen feet an hour, according to depth and freedom from interruption. By a slight tilting of the machine one side of the rail can be ground more than the other if required.

Stealing Bases in Baseball as a Psychologist Sees It

By Arthur Macdonald

THE great thing in stealing bases is to get a good lead, otherwise, according to Kling, it is not wise to steal. Some players seem to have a knack, or instinct, in getting a lead. For the fastest runners do not always steal the most bases. Others study the pitcher to find if there be any preliminary movement of any part of the body which is a sure sign he is going to pitch. In some pitchers a certain peculiar movement of the shoulders may serve as a tip. Cobb makes it a point to observe the direction the baseman looks so as to slide in on the side opposite from which the ball comes. It is well also to observe the elevation of the baseman's hands, so as to know whether the ball is coming high or low.

Usually there are not more than two men on a team who excel as base runners.

It is easier to put out a good base runner than it is to catch a poor one who never can be coaxed far off the bag. But good base stealing often causes fielders to make errors.

The Double and Delayed Steal.—With two out a man on first should try to steal second, so that he can score on a hit. The double steal is almost always attempted when runners are on first and third and two are out.

The delayed steal is where a runner is on second and another on third and the ball is hit to shortstop, who throws home and puts out the man coming from third, but the man on second rushes close after the man running home, and slides in front of the plate before the catcher can recover and touch him after touching out the first runner.

Stealing Third Base.—A runner is on second and a fly ball is hit to short right field. The runner should feign an attempt to get to third. If the fielder, getting the ball, throws to third there is time to get back to second, but if the ball is thrown to second, the runner must break for third, and he will generally get there safely.

One great advantage of stealing third is that the runner can score on a long fly. It is doubtful, however, if he should attempt to steal third when no one is out (of course not when two are out), for he is nearly as well off on second, from which he may score on a hit. Probably the best time to steal third is when only one man is out.

Cobb maintains it is easier to steal third than second, because of the great lead one can get from second.

Basemen.—A celebrated first baseman says that he studies the batter and figures out where he will probably knock the ball, and from whom he will receive the throw. The first baseman can help to stop bunts by standing close to his base and letting the catcher run to his right.

The third baseman is liable to be charged with many errors owing to the distance he must throw to third base. Second is the most strategic of bases.

When a man tries to make a home run on a long hit, the basemen stand on the bags to make him run as far outside them as possible, so that he will lose time.

Base runners caught napping may be regarded as runs killed.

Plays and Tricks.—It is probably true that there is more elation from a smart trick than a great catch. While all plays and tricks are similar to experts, the main point is to utilize them when not expected. For the unexpected wins games, especially between teams closely matched, and plays and tricks afford the best chances for this.

The Bluff Bunt.—One of these plays is the bluff bunt which is used as a substitute for the sacrifice hit to advance runners, especially from second to third base. It is employed when a sacrifice bunt is called for. With runners on second and first, or on second with none out, the best play, according to all authorities, is to sacrifice. The idea is to advance the runners without the loss of a man at the expense of only one strike. The batter pretends to want to bunt, but misses the ball purposely, and shoves his body over the plate so as to interfere slightly with the catcher's vision. The third baseman, expecting a bunt, runs forward rapidly, leaving his base unguarded. The runner on second is to slide in at third before the baseman can return to his base; as he is compelled to run backwards, he must touch blindly at the runner, and chances of a muff are increased. To defeat this play, let the shortstop cover third base. The bluff bunt can assist the delayed steal, but it hampers the catcher in an unfair manner, it is said. This is, however, a difficult point to decide.

A Rapid Play.—A rapid play made by second baseman Evers was where runners were on first and third, one out, and a run badly needed in the ninth inning. The batter hit sharply to second base. Evers took the ball on the first bound and made a motion to hurl it to the home plate. The play was so fast that the runner on third ran back to his base. Evers realizing that a double play was possible, touched the runner from first and then ran to first and put the batter out.

A Trick Play.—Here is a trick play, where a swift base runner was on third, another on first who runs to second, but the catcher refuses to throw to second. Then the runner on second at the pitching of the next ball starts back to first base, and the catcher, supposing that the runner thought there were three out and was going to the bench, threw down to first. But in the meantime, the runner on third, with the motion of the pitcher, had rushed for home. The first baseman seeing this threw at once to home before touching the man running back to first, but it was too late, and the runner rested on first once more; but a run had been scored.

A Fine Play.—A fine play is where a man was on third and the batter drove a hard one to the pitcher. The runner on third, at the crack of the bat, started for home, but seeing he would get out if he continued, stopped still on the base line. This forced the pitcher to come over to touch him. The runner waited until the pitcher was about to put the ball upon him, when he jumped away, and dashed for home and made it. The point was in getting the pitcher on the base line, so that when he threw to the catcher he had to throw on the side of the runner, and this made a bad throw.

An Intricate Play.—It is the ninth inning, score 4 to 2 in favor of team in the field. The opposition has runners on first and third, with one out. A ball is hit to the outfield. The fielder may figure to throw the ball home and get the runner farthest advanced out. There will then be two out, but the runner from first may advance on the throw to second and be in position to score on a base hit. The fielder, however, can throw to second on a chance to get the runner from first. The score would be 4 to 3, and if the runner were held in first, there would be a chance for a double play and winning the game.

Plays to Retire Runner on Third.—A runner on third and the ball is hit to the shortstop, who makes a motion to throw to first, but instead hurls it to third, getting the runner out, for he is liable to take a big lead off his base. Another way to put the man on third out, when far off the bag, is for the catcher to throw to the third baseman high, who purposely lets the ball go by. But the shortstop is back of him to get the ball and throw it home.

The Trap Fly Play.—The trap fly play is where runners are on first and second, and an outfielder coming in close for a fly (the runners holding their bases) instead of catching it, purposely takes it on the short bound, and throws to second, forcing the man on first out, and the man on second is caught between second and third. It is a difficult play and not often used.

Play When Weak Batters are Coming Up.—Runners are on second and third, none out, and weak batters are coming up. An easy grounder goes to shortstop (playing in), who could put the man out running to first, but he holds the ball purposely to have three men on bases. The next batter sends a roller to second baseman, who immediately throws it home (one out), the catcher sends it to first (two out). In the meantime, the man on second is on his way to home, where he is caught (three out) by throw of first baseman back to home. In general, when the bases are filled the chances for double plays are increased.

To Stop Hit and Run Play.—A good time for the hit and run play is when there are two balls and one strike on the batter, unless the pitcher has had bad control. In order to stop the hit and run play, when the batter knocks a fly to outfield, the base runner hearing the crack of the bat must judge from actions of the fielders what is happening. The shortstop and second baseman should go through all the motions of expecting to stop a grounder or drive after a hit. The runner, thus made to think that the ball has gone through the infield, rushes down to second in order to avoid being forced out.—Abstracted from *American Physical Education Review.*

Making Gas Tubing Out of Glue

SUCCESSFUL attempts have recently been made to manufacture a substitute for rubber tubing out of masses of solidified glue. These tubes, whose trade name is "Sonjatin," are even better than those of rubber for certain purposes, according to *Technische Monatshefte* (Berlin, April 10th), since they are more impervious to gases and more resistant to heat. It is also claimed that they do not grow rotten so quickly as rubber, and that when incased in a suitable envelope they will withstand high pressure.

Moreover, they are very cheap, gas tubes of the new material costing only 60 pfennig per meter. The inventor is Prof. J. Traube, and he states that they are peculiarly suited for conductors of petroleum and gasoline as well as gases. However, they are attacked by water, which obviously limits their uses.

NEW BOOKS, ETC.

THE PRINCIPLES OF FRUIT GROWING. With Applications to Practice. By L. H. Bailey. New York: The Macmillan Company, 1915. 8vo.; 432 pp.; illustrated. Price, $1.75.

In its twentieth edition this well-known treatise comes to us as practically a new work. It has been re-arranged, re-set, and largely re-written. The fullness of those 20 years has brought to the fruitgrower a riper knowledge. Garden pests have been subjected to scientific investigation, and the present edition embodies the results of that labor. Fertilization, and protection against frost, are also subjects that receive the consideration their importance demands. The work summarizes the best modern practice. It considers location and climate, the tilling and enriching of the land, the plants and the planting, the lay-out of the orchard and its subsequent care, accidents and injuries to the trees and fruit, and spraying. The work does not stop at successful cultivation, however, but adds a chapter on the harvesting and marketing of the fruit. This includes grading and packing, farm packing-houses and appliances, and the storage of fruits on the farm.

MOTION OF LIQUIDS. By Lieut.-Col. R. De Villamil. R. Eng. (Ret.) New York: Spon & Chamberlain, 1914. 8vo.; 210 pp.; 86 illustrations; 30 tables. Price, $2.50.

If Riabouchinsky fulfills his promise to repeat the experiments of those neglected, almost forgotten investigators, Dubuat and Duchemin, we may look for a new impetus toward the solution of the problems presented by immersed bodies; for there can be little doubt that the former anticipated Bessel by some 40 years, while the latter is warmly praised by both Langley and Zahm. Lieut.-Col. De Villamil, in this thoughtful work on the "Motion of Liquids," vindicates certain of the experiments and conclusions of Dubuat and Duchemin, and applies these conclusions to definite instances of resistance. He finds that, although neither of the investigators in question can have known of what we term the conservation of energy, yet when their experiments are examined from the modern viewpoint it is found that the energy is duly accounted for. Hence he has confidence in the general accuracy of their conclusions. In this interesting account of his own experiments the author confines himself chiefly to flat plates, so that the resistance of viscosity may be so negligible as not to complicate the problem. Some new subjects are introduced, such as the comparison of static with non-static liquids, leading to deductions which may vindicate Dubuat's Paradox; and in the chapter on "negative resistance" he attempts to demonstrate that viscosity may actually cause a decrease in the resistance of a body moving in fluid.

RAILROADS. Finance and Organization. By William Z. Ripley, Ph.D., Nathaniel Ropes Professor of Economics in Harvard University. New York: Longmans, Green & Co., 1915. 8vo.; 638 pp.; with 29 maps and diagrams. Price, $3 net.

In throwing a network of rails over our continent, weighty physical and fiscal problems have been encountered and solved, and no less weighty questions of legal and moral rights have been created. At the present moment a most difficult situation obtains, due to several factors, of which past corporate dishonesty and present public ignorance are perhaps the most apparent. Private interest has been forced to yield itself to public control, and sweeping adjustments and rehabilitations have to be carried out under decidedly adverse conditions. Few men are more capable of filming the old history and the new problems than Prof. Ripley. The photographic sharpness of his descriptions awakens our faculties to a corresponding enlightenment. He discloses the history, the secrets, and the present status of constructive finance, of capital and capitalization, of securities, of speculation, and of stock-watering; he explains state regulation of security issues, considers the determination of reasonable rates, and discusses physical valuation. His attitude is impartial, his evidence impressive, and his arguments sound. Always his confident penstrokes go to the building of definite conceptions. The work should be widely read, as should its companion volume, on "Rates and Regulation."

PROFITABLE VOCATIONS FOR BOYS. By E. W. Weaver, Pd.M., and J. Frank Byler, Ph.D. New York: The A. S. Barnes Company, 1915. 12mo.; 283 pp. Price, $1 net.

This is a splendid book to place in the hands of parents, ministers, educators, and even in the hands of the boy himself. It summarizes much reliable information regarding admission to the gainful occupations. It does not, however, leave the matter there, but adds interesting suggestions as to methods of advancement. It tabulates the remuneration that may reasonably be expected from the various pursuits, and endeavors to induce an analytic attitude in order that a wise choice may be made with all due consideration of temperament and aptitudes. The occupations considered run the gamut of the alphabet, from that of accountant to that of waiter. The factory, the printing, metal, and building trades, office work, salesmanship, the civil service and the engineering professions, are lucidly placed before the reader in all their branches and phases. Architecture, the law, medicine and journalism are included, with many other vocations. In many instances the personal experience of successful men is given in their own words, with the helpful incidents of their upward climb. The work deals with a subject that cries for wider and more careful attention than it has received in the past, and we know of no brief discussion that better covers the ground.